CIM DIRECTORY FEATURE

NSDME REPRINT 84 - 5

Mining in Nova Scotia—Past and Present

by HOWARD V. DONOHOE, JR.

Introduction

Nova Scotia has a rich and varied mineral heritage, represented by a wide variety of mineral commodities. Many of those have yet to be properly evaluated and exploited. Beginning with the establishment of permanent British and French colonies in Nova Scotia, mining has always played an important role in shaping the economic development of the Province. Nova Scotian mines have produced aggregates, antimony, barite, celestite, coal, copper, dimension stone, gold, gypsum, iron, limestone, lead, manganese, molybdenum, salt, silver, and tungsten. Historically gold and coal have been the central commodities of the Province's mining sector. In the last several decades base metal mining has become important, although at present no base metal mines are producing. Since the end of World War II the mining of industrial minerals and aggregates has become the mainstay of the industry along with coal. Renewed interest in gold in the numerous gold districts of the Province has brought about several development plans. Much of the renewed optimism in Nova Scotia results from the decision by Rio Algom to go into production with its tin project at East Kemptville near Yarmouth.

The purpose of this paper is to present the historical development of mining in Nova Scotia and to emphasize the present day significance of mining to the Provincial economy.

Geology of Nova Scotia

Introduction

Nova Scotia possesses a diverse geological history within the Appalachian Mountain belt. Few provinces have such a diversity of geology and hence the possibility of as much mineral potential in such a small area.

Howard V. Donohoe, Jr.

Howard Donohoe was born in Georgia and attended Lehigh University in Bethlehem, Pennsylvania where he received his B.A. and M.Sc. degrees in geology. His Masters thesis concentrated on the structure and mineral occurrences in the western Notre Dame Bay area of Newfoundland. The thesis work was assisted by employment with BRINCO. In 1968 he came to the University of New Brunswick for work on a Ph.D. under Richard Brown and later Nick Rast. The degree was granted in 1978. During his time at UNB he taught at both the Saint John and Fredericton campuses.

Dr. Donohoe joined the Nova Scotia Department of Mines and Energy in 1974. He supervised the geological mapping program in the Cobequid Highlands of northern Nova Scotia. Later he worked in the Fourchu-Louisbourg region of southeast Cape Breton Island on a mapping project.

At present he is in charge of the Education and Public Awareness program in the Mines and Minerals Branch of the Department. In this capacity he manages the Branch displays at the Annual Open House and the PDA Meeting, produces pamphlets and brochures about Nova Scotia's minerals and mining, teaches a prospecting course, and looks after other education-related projects.

Dr. Donohoe is a member of the PDA, GSA, AGS and the Chamber of Mineral Resources of Nova Scotia. He is a Fellow of the GAC and Past-President of the Atlantic Geoscience Society (AGS).

The Province is essentially divided in half along the east-west trending Glooscap Fault (Fig. 1). South of the fault most of southern Nova Scotia is dominated by the Cambro-Ordovician, gold-bearing Meguma Group and the Devono-Carboniferous granitoid rocks. Silurian to Devonian siltstones and sandstones rest conformably above the Meguma Group. These strata are unconformably overlain by the Early Carboniferous sandstones, limestones, and evaporitic deposits. Late Carboniferous rocks occur in two isolated areas in southern Nova Scotia and unconformably overlie older rocks.

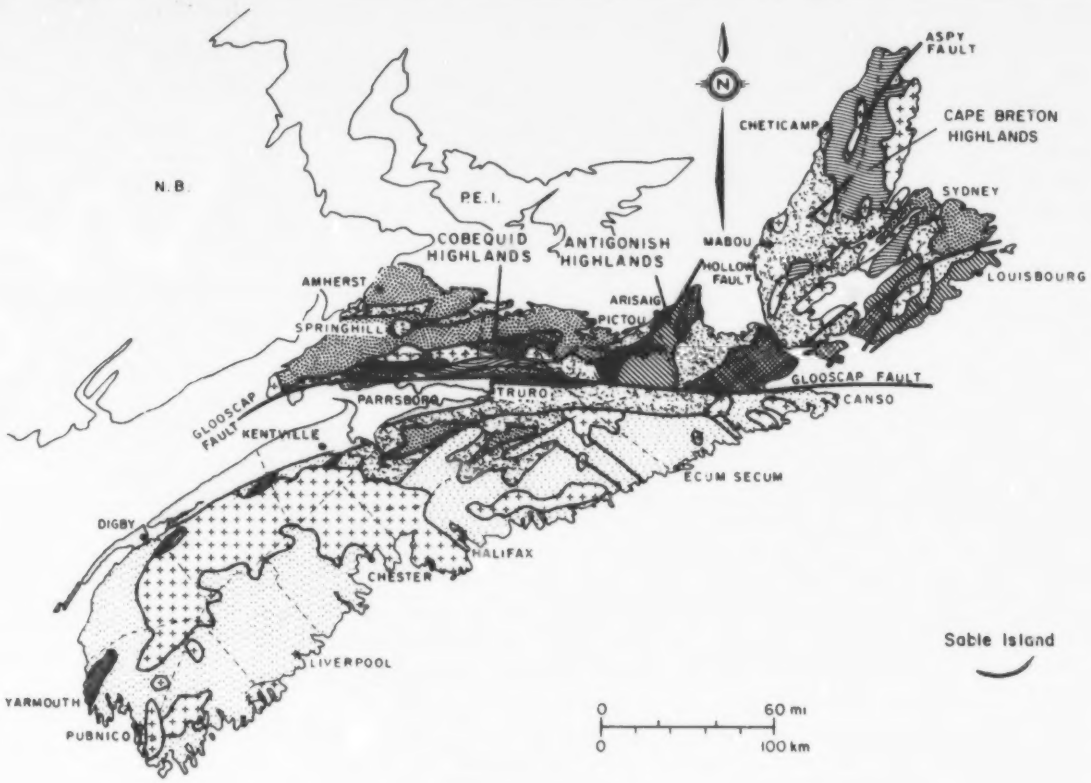
Northern Nova Scotia is characterized by numerous fault blocks. In the Cobequid Highlands and the Cape Breton Highlands some of the faults have brought up the crystalline basement rocks. Radiometric ages are older than 750 Ma and in one location in the Cobequid Highlands the Rb/Sr whole rock age is 934 ± 82 Ma (Gaudette *et al.*, 1983). Younger Precambrian rocks occur in all three highland areas (Fig. 1) and are dominated by volcanic rocks. Limited areas of Cambro-Ordovician strata are exposed in northern Nova Scotia; the largest of these is in southeast Cape Breton Island. Silurian to Devonian strata unconformably overlie the older Paleozoic and Precambrian rocks on the northern mainland. In Cape Breton no Silurian strata have yet been identified. In parts of western Cape Breton Island and the Antigonish Highlands and large areas of the Cobequid Highlands felsic and mafic subaerial volcanic rocks unconformably overlie the older rocks. These rhyolites and basalts are Late Devonian to Early Carboniferous in age. They are succeeded by the red sandstones and shales, limestones, and evaporites of the Early Carboniferous. Large areas of the northern mainland and many small areas on Cape Breton Island are underlain by the coal bearing Late Carboniferous strata.

Late Triassic and Early Jurassic red sandstones and shales and basalts occupy the low land between Truro and Parrsboro and much of the Bay of Fundy and the adjacent shoreline of Nova Scotia. Small deposits of Cretaceous pure quartz sandstone and clay are found in many lowland areas of northern and southern Nova Scotia and Cape Breton Island.

Metallotects and Mining Operations

Geological mapping in Nova Scotia by Department geologists, officers of the Geological Survey of Canada, and university geology groups has established discrete geological terrains with certain distinctive metal/non-metal associations. These discrete terrains, called metallotects, are located as shown in Figure 2. The Precambrian rocks in Cape Breton Island form a Cu-Pb-Zn-Ag metallotect. The base metal mine at Stirling (see Fig. 6) is an example of polymetallic mineralization and is located in volcanic rocks of the "Younger Precambrian" (Fig. 1). The older Precambrian rocks host Zn and Cu-Zn mineralization in metasediments and marbles. The copper mine at Coxheath is located in this metallotect. The Cambro-Ordovician metallotect contains all the important gold producers (see Fig. 3) in the Province. Several of the former gold mines also produced tungsten (Moose River, Fig. 6) and antimony (West Gore, Fig. 6) as well as other sulphides. The bimodal volcanics of Devonian to Carboniferous age are hosts for epithermal U-Th-Mo-Au-Ag-Cu-Pb-Zn mineralization. As yet no mines have been developed in this terrane.

The Devono-Carboniferous intrusive suite, primarily in southern Nova Scotia forms a Sn-Sb-Li-U-Th-Be-Mn metallotect. Manganese mines and tin occurrences were located at New Ross. The East Kemptville tin mine is located



SEDIMENTARY AND VOLCANIC ROCKS

TRIASSIC TO JURASSIC: red and tan sandstones and shales; basalt flows

YOUNGER CARBONIFEROUS: red, grey and tan sandstones and shales, coal

OLDER CARBONIFEROUS: conglomerate, sandstone, shale, limestone, salt and gypsum

DEVONIAN: red and grey conglomerate, sandstone and shale, rhyolite and basalt flows

SILURIAN TO EARLY DEVONIAN: grey then red sandstones and siltstones

CAMBRIAN TO ORDOVICIAN: grey standstone and black shale (metamorphosed to quartzite and slate in southern Nova Scotia, named the Meguma Group)

YOUNGER PRECAMBRIAN (Proterozoic III): metamorphosed volcanic rocks, sandstones, shales

OLDER PRECAMBRIAN (Proterozoic II to III): strongly metamorphosed rocks consisting of quartzite, marble, schists and para- and ortho-gneisses

IGNEOUS ROCKS

INTRUSIVE IGNEOUS ROCKS: granites, granodiorites and diorites; ages are Late Precambrian to Cambrian (found mostly on Cape Breton Island) and Devonian to Early Carboniferous

FIGURE 1. Geological map of Nova Scotia.

at the southwest end of the Devono-Carboniferous South Mountain Batholith.

The Carboniferous strata of Nova Scotia form three separate metallotects. The oldest of these exhibits anomalous concentrations of Cu-Pb-Zn-Ag of Early Carboniferous age. No former mining areas are found in this metallotect. Strata of Visean age (primarily the Windsor Group) are presently (and have been historically) an important mining focus for Cu-Pb-Zn-Ag-Ba-Sr. Mines at Walton and Gays River produced the greatest amount of the Province's base metal production. Strata of the Windsor

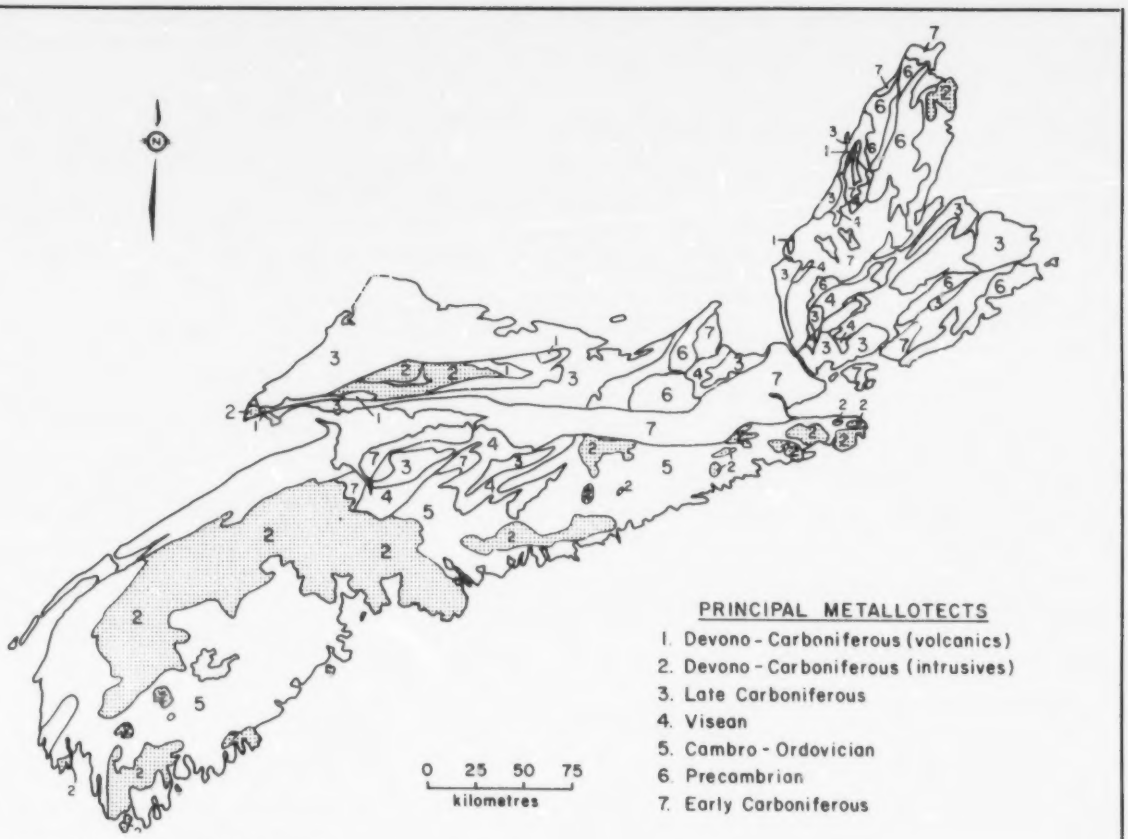


FIGURE 2. Location of metallotects.

TABLE 1. Primary resource industry contribution to Real Domestic Product in Nova Scotia during 1983 (constant 1971 dollars; millions of dollars)

	1976	1977	1978	1979	1980	1981	1982	1983	1984*
Mining RDP	$ 59	$ 63	$ 79	$ 66	$ 90	$ 95	$ 82	$ 94	$ 99
Total RDP	$2 656	$2 730	$2 866	$2 917	$2 990	$3 082	$2 942	$3 034	$3 147
Mining Contribution (per cent)	2.2	2.3	2.8	2.3	3.0	3.1	2.8	3.1	3.1
Fishing Contribution (per cent)	1.7	1.9	2.0	1.9	1.6	1.6	1.6	1.7	1.6
Forestry Contribution (per cent)	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4
Agriculture Contribution (per cent)	1.2	1.4	1.4	1.3	1.3	1.4	1.5	1.4	1.4

Source: Nova Scotia Department of Development, 1984
*Projected figures

Group are dominated by limestone and substantial thicknesses of evaporites (salt, gypsum, anhydrite, and some potash and celestite).

The Late Carboniferous metallotect is dominated by large sedimentary basins with copper, lead, zinc, iron and barite deposits. These are the rocks which contain the large economic deposits of coal (Fig. 3). Base metal mines were operated at Yava, Waugh's River, and areas adjacent to the north side of the Cobequid Highlands.

Contribution to Nova Scotia's Economy

The mining industry in Nova Scotia makes a modest but significant contribution to the Provincial economy (Table 1) and has been a leading industry in growth in Real Domestic Product (RDP) and employment between 1971 and 1983. Recent expansion of the coal and industrial mineral base and the emerging diversification into metallic commodity production is instilling growing confidence for an even stronger mining industry in Nova Scotia throughout the 1980s.

The Nova Scotia mining industry contributed 3.1 per cent of the primary Real Domestic Product of Nova Scotia in 1983, up from 2.8 per cent in 1982 (Table 1). Mining's RDP has declined only twice in the last seven years, each time during a recessionary period for the economy of Canada. Mining in Nova Scotia contributed approximately $17,570 to the RDP for every person employed in mining during 1983 exceeding each of the other primary industries in the Province.

Expressed in terms of primary RDP, the contribution of the mining sector compares favourably with the input from each of agriculture, fishing, and forestry (Table 2). In 1983, the RDP for mining ($95 million) almost surpassed the combined total for agriculture and fishing, with forestry in fourth place at $11 million (Table 2).

Major factors in this growth have been renewed activity in coal which, by 1982, contributed 60 per cent to the mining Real Domestic Product, and in land-based mining and exploration other than coal. In the last three years, offshore oil and gas exploration has been included in the mining RDP and, in 1982, contributed approximately 10 per cent.

From a national perspective, mining contributes proportionately more to Nova Scotia's economy than in New Brunswick, Quebec, or Ontario (Table 3). The relative importance of Nova Scotia's mining industry is emphasized by the realization that New Brunswick, Quebec, and Ontario each has a well developed and more readily recognized mining industry.

The movement of large tonnages of the Province's mineral resources, especially coal and nonmetallic minerals, by road, rail, and ship contributes substantially to the transportation sector. The increasing use of indigenous coal for the generation of electricity provides a strong linkage between the utilities and mining sectors and an essential component of Nova Scotia's economic framework.

TABLE 2. Comparison of the Real Domestic Product of each basic resource sector in Nova Scotia (constant 1971 dollars; figures in millions)

	Agriculture	Fishing	Forestry	Mining
1983	$43	$53	$11	$94
1984*	$44	$49	$13	$99

Source: Nova Scotia Department of Development and Statistics Canada
*Projected figures

Employment in Mining

Approximately 5,350 Nova Scotians, comprising 1.45 per cent of the total Provincial labour force, were directly employed in the mining industry in 1983. The mining labour force comprises roughly 4000 coal-related jobs and the remainder in mineral-related jobs. Of the other primary resource industries, as defined by Standard Industrial Classifications, only agriculture provided primary employment equal to mining in 1983, fishing and forestry lower.

Besides direct employment, the mining industry contributes to substantial employment elsewhere in the economy. The Nova Scotia Department of Development estimates that for every one hundred people directly employed in coal mining, 73 additional jobs are created elsewhere in the economy. The multiplier for structural materials (aggregates, clay, sand) and nonmetals is 1.64. Table 4 provides the employment multipliers for the three other primary resource industries in Nova Scotia. Mining ranks third behind forestry and fishing. This is primarily due to the backward linkages between industries which supply these sectors. Fishing and forestry currently require slightly greater inputs from other sectors of the Nova Scotia economy.

The mining industry in Nova Scotia shows a rate of recent growth in employment levels that is unmatched by any other industrial sector. Direct employment in mining has grown steadily from approximately 3,000 persons in 1975 to 5,350 persons in 1982, an increase of more than 78 per cent. A significant part of this growth was caused by increased activity in the aggregate industry. During that same period, the RDP for mining also showed substantial real growth (Table 1).

In the face of a major economic downturn in the early 1980s, the growth potential of Nova Scotia's mining industry, as indicated by steadily increasing levels of employment, is clearly documented. In 1982 and 1983 Nova Scotia was in the enviable position of being one of few Provinces in which the mineral industry demonstrated increased employment and increased dollar value of production.

From a national perspective, the proportion of the Provin-

TABLE 3. Contribution of mining to Real Domestic Product in 1983 (constant 1971 dollars)

1983	Gross Domestic Product	Gross Domestic Product of Mining*	Percentage for Mining
Newfoundland	$ 1 524 000 000	$ 1 128 000 000*	8.4
Prince Edward Island	338 000 000	nil	-
Nova Scotia	3 034 000 000	94 000 000	3.1
New Brunswick	2 224 000 000	64 000 000	2.8
Quebec	27 308 000 000	184 000 000	0.7
Ontario	47 179 000 000	415 000 000	0.9
Manitoba	4 648 000 000	92 000 000	2.0
Saskatchewan	4 458 000 000	269 000 000	6.0
Alberta	13 490 000 000	1 404 000 000	10.4
British Columbia	14 023 000 000	351 000 000	2.5
Yukon	N/A	N/A	-
Northwest Territories	N/A	N/A	-

Source: Statistics Canada
*Includes oil and natural gas production

TABLE 4. Industrial employment multipliers

	Coal Mining	Other Mining (Excluding Metals)	Agriculture	Fishing	Forestry
INDIRECT	1.33	1.27	1.24	1.21	1.48
INDIRECT AND INDUCED	1.73	1.64	1.56	1.82	1.89

Source: Nova Scotia Input-Output System, 1979, Nova Scotia Department of Development

TABLE 5. Mining employment as a percentage of total labour force in 1983

1983	Labour Force	Mining Labour Force	Per cent Labour Force in Mining
Canada	12 183 000	148 370	1.22
Newfoundland	214 000	3 640	1.70
Prince Edward Island	55 000	N / A	-
Nova Scotia	369 000	5 350	1.45
New Brunswick	290 000	3 000	1.03
Quebec	3 069 000	18 910	0.62
Ontario	4 570 000	30 000	0.66
Manitoba	508 000	4 660	0.92
Saskatchewan	470 000	8 340	1.77
Alberta	1 249 000	58 110	4.65
British Columbia	1 389 000	13 110	0.94
Yukon	N / A	370	-
Northwest Territories	N / A	2 860	-

Source: Statistics Canada Report 72-002

cial labour force employed in mining in Nova Scotia in 1983 exceeded that of Quebec, Ontario and British Columbia, traditional "mining" Provinces (Table 5).

In recent years, governments have been increasingly concerned with high levels of unemployment and the resulting socio-economic costs to society. In view of its performance in the recent past, the mining industry in Nova Scotia offers a high probability of continued stability and growth in employment.

Early Mining History

Introduction

Mining in Nova Scotia has played an important role in the industrial and social life of the Province since the middle of the 17th century, as revealed by early records of the use of coal and gypsum. From this time to the present, the Province has produced (in addition to coal and gypsum) a great variety of minerals and metals including salt, gold, iron, manganese, barite, copper, zinc, lead, silver, antimony, tungsten and recently celestite.

Coal

Coal has been the most important commodity throughout the history of mining development in Nova Scotia. The key to this development has been Cape Breton Island with its vast deposits of coal as well as many other locations (Fig. 3).

The first attempt at coal mining on Cape Breton Island was in 1720 when it was found necessary to obtain a supply of fuel for the labour force building Fort Louisbourg. Quantities of coal were soon being mined to supply the militia at Halifax as well as markets along the eastern seaboard of the United States. The first recorded export of minerals from Canada occurred in 1724 when coal was exported from Cape Breton to Boston.

In 1826, the Crown granted to Frederick, Duke of York, the right to all minerals in the Province. The Duke, being hard-pressed by his creditors, immediately subleased the mines to the General Mining Association for financial consideration. From 1826 to 1850 this group held a mineral monopoly on large coal tracts in Cape Breton and on the mainland. In 1858, the mineral rights on all areas under the monopoly were surrendered to the Crown and from that time came under the jurisdiction of Nova Scotia. The Association was given 20 miles^2 (52 km^2) in Pictou, Joggins, and Springhill (Fig. 3) for the mining of coal.

In 1893, the Dominion Coal Company, Ltd. was formed and obtained control of all coal mines in the Sydney - Glace Bay region, specifically the properties on the eastern side of Sydney Harbour, under a ninety-nine year lease. Leaseholds of subsidiaries of the Dominion Coal Company and independent operations were also under development by this time in other areas of Cape Breton Island and on the mainland in Pictou, Joggins-River Hebert, and Springhill. In the Sydney region a total of 258 million tons (232 million tonnes) was produced up to 1976.

Coal was discovered in the Pictou Coalfield in 1798 on McCulloch's Brook. The Foord Seam was worked in the early 1800s and the General Mining Association took over the field in 1827. The earliest recorded production figures are for 1867. In 1873, the General Mining Association withdrew from the field. After this time independent companies began operations, namely, the Acadia Coal Company, and the Intercolonial Coal Mining Company in the Westville area. Mining continued sporadically in many different mines into the 1900's with most operations ceasing by 1960. The only presently operating mine is the Drummond Mine in the Westville area. Total production was 63 million tons (56 million tonnes).

The first recorded mining in the Cumberland Basin dates to the early eighteenth century when the "Old French Workings" were mined in Joggins. The General Mining Association had the rights to coal mining in this area, but did not operate a mine until 1847. In 1858, the General Mining Association relinquished all rights to the Cumberland coalfields except for small grants in Joggins and Springhill. In 1879, the General Mining Association grant in Springhill was taken over by the Springhill and Parrsboro Railway Company, which in turn was succeeded by the Cumberland Railway and Coal Company in 1884 and the Dominion Coal Company in 1911.

The Dominion Coal Company continued to work the Springhill mines through the 1900s with the last operating mine closing by 1970.

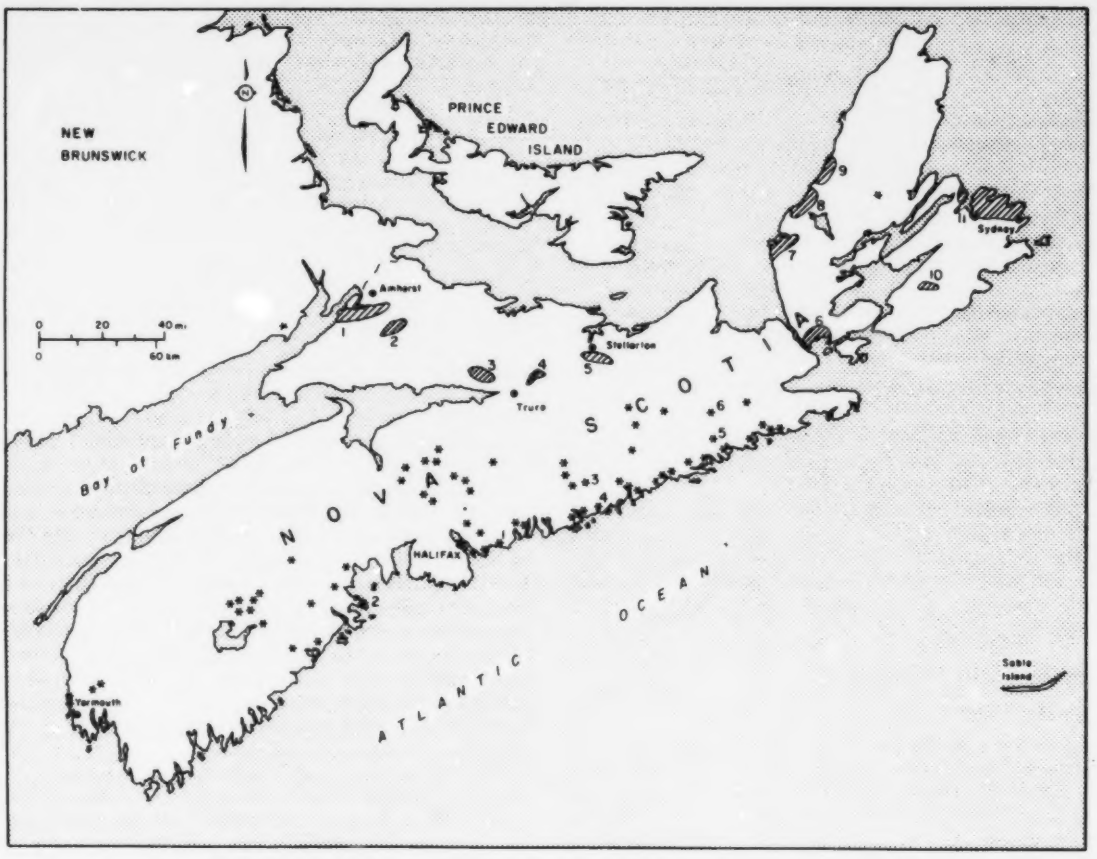
At Joggins and River Hebert, the Joggins Coal Company and the Maritime Coal, Railway and Power Company Limited were the largest producers. Most of the mines in the Joggins-River Hebert field worked until the 1940s with several closing in the 1960s. The River Hebert/Cochrane Mine, closed in 1980.

The River Hebert-Joggins area and Springhill area achieved a total production of 49 million tons (44 million tonnes).

The other coal mining regions in the Province produced 10 million tons (9 million tonnes) of coal up to the 1960s. Total production of coal increased dramatically in the late 1800s with the advent of large industrial organizations (Fig. 4).

Gradually though, with the market for this fuel dropping, many mines closed. In 1968, the operations of all remaining coal mines in the Sydney coalfield were taken over by the Cape Breton Development Corporation. At that time the Corporation was operating the Princess Mine (Sydney Mines), No. 20 and 26 collieries (Glace Bay) and the No. 12 colliery (New Waterford). In 1971 the No. 12 and No. 20 collieries were closed followed by the Princess Mine in 1975. CBCD opened two new mines, the Lingan Mine (New Waterford) in 1972 and the Prince Mine (Pt. Aconi) in 1975. Mine development work in the new Donkin mine is continuing east of Glace Bay.

Because of the rising cost of crude oil in the 1970s, coal became an economic alternative for electric power generation in Nova Scotia which revitalized the mines otherwise destined for eventual closure. Although recent production levels are



GOLD DISTRICTS ✱

1. Lawrencetown
2. The Ovens
3. Mooseland (Old Tangier)
4. Tangier
5. Goldenville
6. Cochrane Hill

COAL FIELDS ▨

1. Joggins - River Hebert
2. Springhill
3. Debert
4. Kemptown
5. Pictou
6. Richmond
7. Port Hood
8. Inverness - Mabou
9. Chimney Corner - St. Rose
10. Glengarry Valley
11. Sydney

FIGURE 3. Gold districts and coal fields in Nova Scotia.

substantially lower than those of the early part of this century, they have grown dramatically since 1973 and demand pressures are expected to continue to rise (Fig. 4).

Metallic Minerals

Gold

One of the most spectacular mineral developments in Nova Scotia in the 1800's was the discovery and mining of gold. Gold was probably found by the Micmacs long before the first European settlers. Along the Eastern Shore (northeast of Halifax) gold was described by farmers around Lawrencetown in 1848 (Fig. 3). Gold had been found at the Ovens prior to 1860.

The first official discovery of gold in Nova Scotia was made in Mooseland, Halifax County, by Capt. C. L'Estrange while on a hunting expedition in 1858. It was not publicized, however, and received no attention. In 1860, John G. Pulsiver of Musquodoboit, accompanied by Indian guide Joe Paul, who was also with L'Estrange when he made his discovery, visited the Mooseland district where he noted the presence of gold in the quartz veins. This was reported to Peter Mason of nearby Tangier along with the details of the rock formation in which the gold occurred. With the knowledge that similar rock structures existed in Tangier a search by Mason soon revealed the presence of gold in a small brook in October of the same year. Further discoveries at both the Mooseland diggings and Tangier the following spring prompted a frenzied rush.

The Mooseland findings never assumed major proportions and Tangier gained the distinction of developing the first recognized gold mining camp in the Province. On April 11, 1861, Wm. Anderson, Deputy Surveyor, took possession of Tangier District on behalf of the government in order to protect the landowners and secure the mineral rights. In May 1861 Tangier and Mooseland were officially surveyed and proclaimed gold districts by the Provincial government. Eventually forty such districts were proclaimed throughout the Province, all but one in southern Nova Scotia. By September 1865, 95 mines

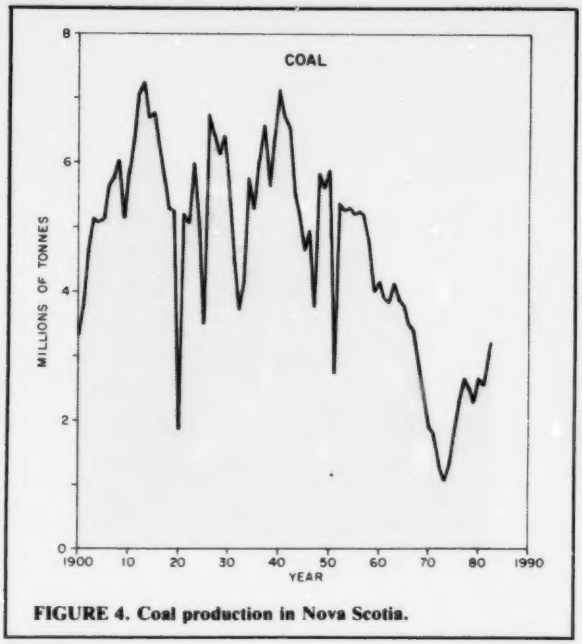


FIGURE 4. Coal production in Nova Scotia.

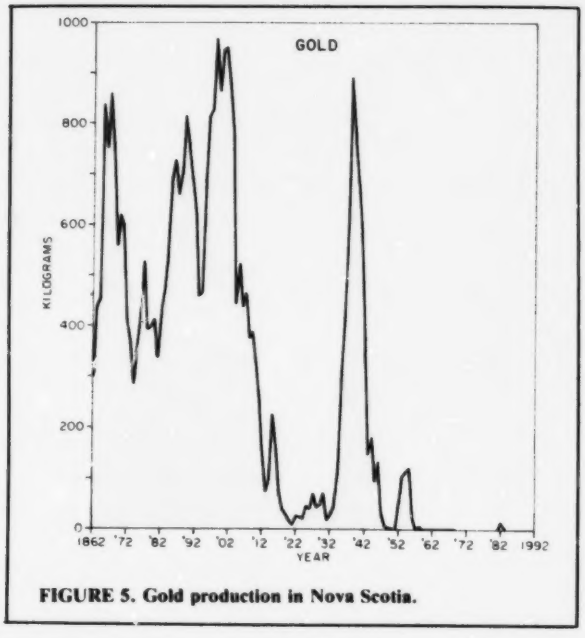


FIGURE 5. Gold production in Nova Scotia.

had been established in the gold districts. The gold ore was milled at 34 gold mills, twelve of these were powered by water and the remainder by steam (Hartlen, 1983).

There were approximately sixty small mines producing gold in the 1800s. The annual value of production of gold ranked second only to coal at the turn of the century, and in 1900 a record yield of 33,955 ounces (950,740 g) of gold was achieved. The largest all time producer of gold was the Goldenville District with 210,000 ounces (5,800,000 g) produced during the period 1862-1942.

By the early 1900s the Klondike gold rush was in full swing. This, and the mining camps of Ontario, attracted men and financing away from the Province, and gold mining gradually declined until 1933 when a revival of activity in practically all of the old districts resulted in an annual production of 28,600 ounces by 1938 (Fig. 5). After the outbreak of World War II, the Province closed its mining areas to further gold prospecting (Hartlen, 1983). Following the cessation of hostilities the rising costs of labour and supplies contributed to practically a complete stoppage of gold mining by 1950. The production of gold and silver between 1951 and 1958 shown in Figure 4 resulted from the by-product separation in the Cu-Pb-Zn ore of the Stirling Mine (Fig. 5). The total production of all gold mining, up to 1981, was 1,143,000 ounces (32,004,000 g) of gold.

In the late 1970s, large increases in the price of gold produced a strong resurgence in exploration activity for gold in southern Nova Scotia. Re-examination of many former producing areas for large tonnage - low-grade gold production has lead to several development opportunities. Tests of gold recovery by heap leaching from low-grade ores were made at the old Cochrane Hill District by Northumberland Mines (Fig. 3). Durings these tests 561 ounces (15,940 g) were produced.

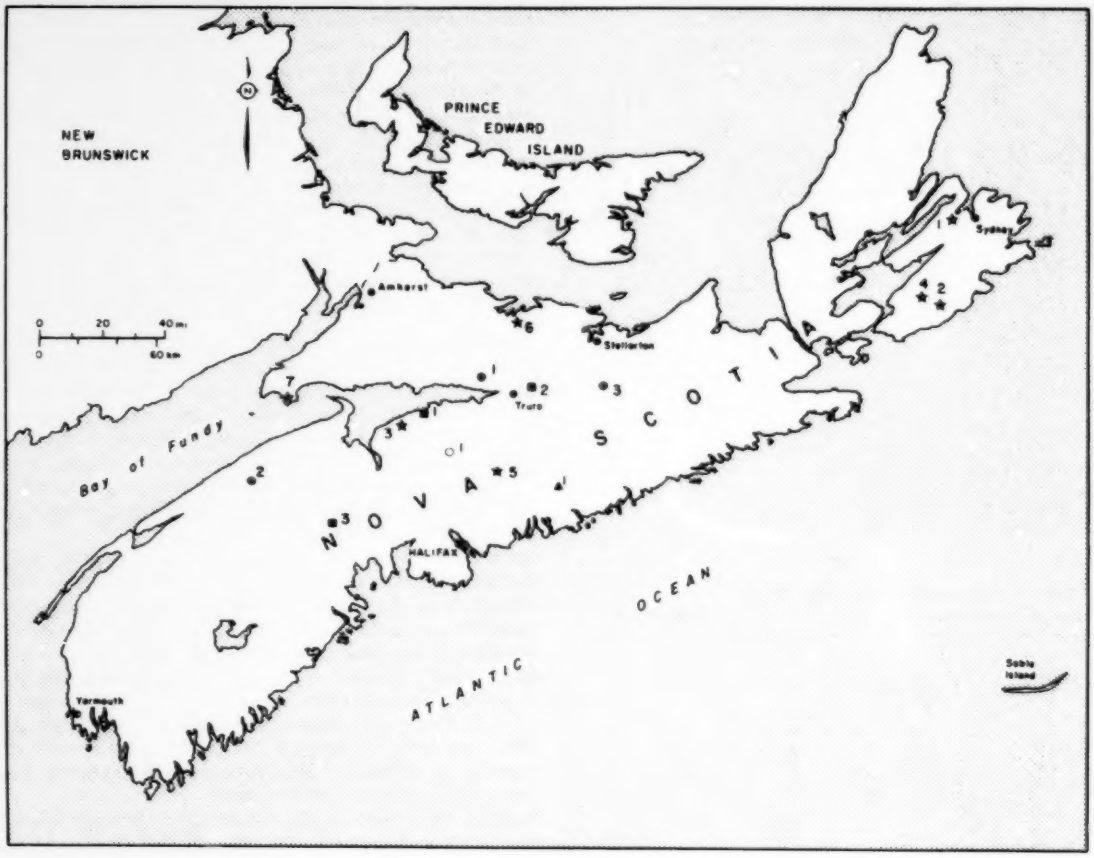
Base Metals (Copper, Lead, Zinc)

Commercial production of base metal ores in Nova Scotia began in the present century. Many occurrences had been investigated but, for the most part, they were submarginal in value in terms of the prevailing market prices. Attempts were made, in the latter part of the nineteenth century, to mine galena (lead) at Smithfield, and zinc-lead-copper sulphides at Stirling in Cape Breton, but only the Stirling property became an operating mine.

Smithfield. An early mining development was tried at Smithfield (Fig. 6) in the last part of the nineteenth century and again in 1925 to 1927. Small tonnages of ore were produced from a partially replaced limestone bed at the base of the Windsor Group. Heavy, wet ground and the erratic occurrence of ore zones, coupled with fluctuating market prices caused cessation of operations in the early stages of development. The same factors caused the stoppage of further attempts, during 1951 and 1952, to develop the property. Stevenson (1956) reported an orebody of 550,000 tons (495,000 tonnes) grading 6 per cent combined lead and zinc.

Stirling. The history of the Stirling (Fig. 6) copper-zinc-lead property goes back to the discovery in 1885 of Cu mineralization although lead and zinc were also known to be present. The complexity of the ore was for many years beyond the available metallurgical techniques and little in the way of mining was accomplished. It was not until 1915 that the possibility of recovering the zinc content was even considered. The orebody consists of irregularly shaped lenses of sulphides in a quartz-carbonate envelope occurring within a persistent, wide, steeply dipping shear zone. This shear zone cuts altered volcanic and sedimentary rocks of the Fourchu Group (Miller, 1979) of Late Precambrian age.

Between 1915 and 1924 five different companies held the property. In 1925 the North American Cyanamid Company, through its subsidiary Stirling Zinc Ltd., undertook the first underground operations, sinking a two-compartment shaft to a depth of 40 feet (122 m) from which a certain amount of lateral work was done. In 1928 British Metals Corporation (Canada) Ltd. obtained control of the property through its subsidiary, Stirling Mines Ltd. The mine operated intermittently in response to fluctuations of the metal markets, the longest period being from 1935 to 1938. During this period 196,479 tons (17,831 tonnes) of copper-lead-zinc ore was milled (Fig. 7). The average grades were 10 per cent Zn, 2.3 per cent Pb, and 1.0 per cent Cu. In addition gold and silver were recovered: gold 0.04 ounces/ton (1.24 g/tonne) and silver 2.5 ounces/ton (77.5 g/tonne). At the beginning of World War II production was finally suspended and the claims allowed to lapse. In 1950 extensive diamond drilling and a geophysical survey located new orebodies with the result that the Mindamar Metals Corporation Ltd. was organized with Dome Mines holding the major interest. A new four-compartment shaft was completed followed by the erection of a 500 ton/day mill. Milling began in April 1952 but the mine closed four years later. By that time 863,115 tons (776,803 tonnes) of ore had been milled (Fig. 7). The ore graded 5.5 per cent Zn, 1.3 per cent Pb and 0.7 per cent Cu. Silver and gold were also recovered.



BASE METALS ★
1. Coxheath (Cu)
2. Stirling (Cu-Pb-Zn-Au-Ag)
3. Walton (Cu-Pb-Zn-Au-Ag)
4. Yava (Pb)
5. Gay's River (Pb-Zn)
6. Waugh's River (Cu)
7. Cape d'Or (Cu)

IRON ⊕
1. Londonderry
2. Nictaux-Torbrook
3. Bridgeville

TUNGSTEN ▲
1. Moose River

MANGANESE ■
1. Tennecape
2. Manganese Mines
3. New Ross

ANTIMONY ○
1. West Gore

FIGURE 6. Former metallic mineral mining areas of Nova Scotia.

Walton. In 1958 underground drilling in the large barite mine of Magnet Cover Barium Corporation at Walton intersected promising lead-zinc-copper-silver ore at the base of the barite. The mineralization is located in an area of numerous faults in the lowest parts of the Windsor Group (Boyle, 1972). Subsequent drilling established a sizeable orebody lying beneath the barite; by the end of 1961, a 125 ton/day (112 tonne/day) mill was placed in operation. The Corporation, which changed its name to Dresser Minerals Ltd. in 1967, maintained metal concentrate production until 1974. By the time the mine had closed, it had produced 62,650 tons of combined lead, zinc, and copper concentrate and 3,475,760 ounces (97,321,280 g) of silver.

Gays River. In the 1970s the focus of attention for base metals shifted to the Gays River-Musquodoboit Valley area and the local base (reef complex) of the Windsor Group. Canada Wide Mines, a subsidiary of Esso Canada Ltd., opened a 1000 ton/day (900 tonne/day) mine/mill complex in 1979. It closed prematurely in 1981 due to low lead and zinc prices combined with mining difficulties due to excessive water in the mine. The mine produced 703,350 tons (633,000 tonnes) of combined lead-zinc ore.

Yava Mine. Exploratory work in the Salmon River area of Cape Breton from 1946 through 1966, delineated large tonnages of medium- to low-grade lead ore. In 1962 Talisman Ltd. indicated reserves of 44,000,000 tons (40,000,000 tonnes) of galena-bearing sandstone of Late Carboniferous age averaging 2.70 per cent lead. Between 1962 and 1969 Phelps Dodge Corporation conducted extensive drilling and exploration on the property and prepared a feasibility study. In 1976 Barymin Explorations assumed controlling interest in Yava by purchasing the interests held by Phelps Dodge and Talisman. The Yava deposit was put into production in 1979 but closed in bankruptcy in 1981 due to low lead prices and high interest rates. A total of 441,210 tons (397,100 tonnes) of lead ore was mined and a small amount of by-product silver was also recovered. Proven reserves, grading an average of 4.4% lead, total 1.95 million tons (1.77 million tonnes) (Bonham, O.J.H.,

TABLE 6. Coal production in Nova Scotia, 1983

Company	Mine Name	Location	Production (saleable coal) (tons)	Production (saleable coal) (tonnes)	Total[1] Number Employed	Approximate Value[3]
Underground Mining						
Cape Breton Development Corp. (CBDC)	Prince Mine No. 26 Colliery Lingan Mine	Point Aconi, Cape Breton County Glace Bay, Cape Breton County Lingan, Cape Breton County	3 034 699[2]	2 758 817[2]	4 450	
Evans Coal Mines Ltd.		St. Rose, Inverness County	47 892	43 538	53	
Drummond Coal Co.		Westville, Pictou County	13 902	12 638	40	
		TOTAL (underground)	3 096 492	2 814 993	4 543	
Open-Pit Mining						
T. Brogan Ltd.		Point Aconi, Cape Breton County	33 901	30 819	10	
Novaco		Point Aconi, Cape Breton County Springhill, Cumberland County	236 456	214 969	23	
		TOTAL (open pit)	270 357	245 779	33	
Reclamation						
Selminco Inc.		Sydney Mines, Cape Breton County	133 319	121 199	60	
		TOTAL (reclamation)	133 319	121 199	60	
		Total for all Producers	3 500 168	3 181 971	4 636	$167 377 000[3]

[1] Personnel employed in clerical, supervisory, etc. positions as well as mining personnel
[2] Washed coal
[3] Estimate from Nova Scotia Department of Mines and Energy sources

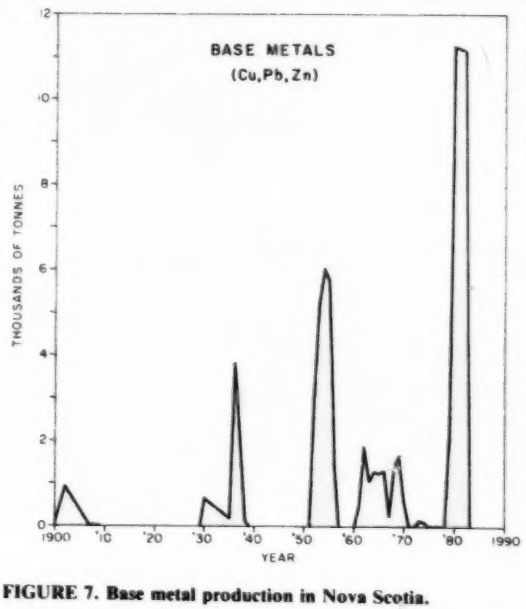


FIGURE 7. Base metal production in Nova Scotia.

1982, Yava Lead Deposit, Nova Scotia Department of Mines and Energy internal report).

Copper Occurrences. Native copper was one of the earliest mineral discoveries in Nova Scotia, having been reported in 1604 at Cap d'Or, west of Parrsboro by members of Samuel de Champlain's exploration parties.

The earliest recorded exploration for copper in the Province was near Caribou, 15 miles (24 km) northwest of Stellarton, by the General Mining Association in 1828. Shortly after they obtained control of the mineral rights from, Frederick, Duke of York, the Association investigated this and other sedimentary copper occurrences in Late Carboniferous strata. No production was recorded from these efforts. During the 1880s and 1890s copper ore in the form of chalcopyrite was mined from Copper Lake located about 35 miles (60 km) southeast of Stellarton. A small copper production was achieved from mining chalcocite associated with carbonaceous bands in Late Carboniferous sandstone along the Wallace River north of the Cobequid Highlands. Around 1907 native copper was mined at Cap d'Or, where it occurred in sheets of brecciated basaltic rock. A total of 1970 tons (1770 tonnes) of copper ore was produced during that year.

Coxheath. Copper occurrences were reported in 1825 from the general vicinity of the present-day Coxheath occurrence located about six miles (9.6 km) southwest of Sydney, Cape Breton. Considerable surface and some underground development took place at that time. During the 1860s and 1870s development work continued although no production figures are given in the Department of Mines reports of those years. The first production is recorded in 1883 with 60 tons (54 tonnes) of copper ore from Precambrian volcanics and intrusives. According to the Department of Mines Annual Reports production continued intermittently until 1896. A total of approximately 3800 to 5000 tons (3400 to 4500 tonnes) was mined.

Early in 1963, an extensive exploration program was begun by Mariner Mines Ltd. for copper occurrences at Coxheath. Following the discovery of molybdenite on the property in 1964, emphasis shifted from the development of a small tonnage, high-grade copper deposit to that of a large tonnage, low-grade porphyry copper orebody. A considerable tonnage of over 3 per cent copper has been defined and large areas of favourable intrusive rocks have yet to be explored.

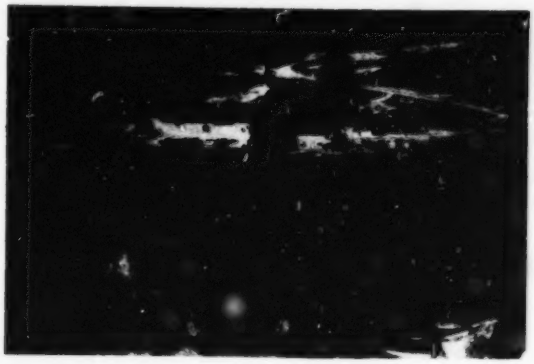
It is noteworthy that, in 1910, specimens of chalcopyrite ore from the Coxheath mine were displayed and awarded first-class diplomas at the World Exposition in Glasgow, Scotland.

Molybdenite

At New Ross (Fig. 6) in Lunenburg County, a shaft was sunk in 1917 to 36.3 ft (11 m) and subsequently to 52.8 ft (16 m). Some lateral work was performed, but only a small test lot of ore was ever shipped from the property. During 1949, the Department of Mines dewatered the mine and carried out more lateral drifting and diamond drilling.

Mining History

John G. Pulsiver, a Nova Scotia prospector, who believed large deposits of gold could be found. He followed up on the first recorded discovery by Capt. C. L'Estrange. Pulsiver was photographed at Dalhousie University circa 1860. (Nova Scotia Museum photo.)



The Walton Mine of Dresser Minerals Ltd. In the foreground is the open pit from which barite was taken. Underground mining from the headframe tapped the Cu-Pb-Zn-Ag orebody below the barite (c.1965).

The Mindamar Mine of the Mindamar Metals Corporation Ltd. at Stirling (c.1954). Silver and gold were produced here in addition to copper, lead and zinc.

The Guysborough Mining Co. mine at Goldenville (c.1935). Goldenville was the richest of the Nova Scotia gold districts.

The mill and shaft of Arno Mines Ltd., Coxheath, Cape Breton. Mineralization consists of Cu-Mo although the mine developed as a Cu prospect.

The copper-molybdenite occurrence near Coxheath and a showing of bismuthinite and molybdenite near Gabarus [10 miles (16 km) south of Louisbourg on Fig. 1], both in Cape Breton, were actively investigated by Mariner Mines Ltd., Louisbourg Mines and the Department of Mines in 1967 to 1969.

Stibnite

Stibnite, the chief ore of antimony, was mined intermittently in Nova Scotia only at West Gore between 1884 and 1917. The ore is auriferous and enclosed in a soft talcose slate. From 1914 to 1917 when the property was mined most extensively, the concentrates were shipped to the St. Helen's Smelting Company, Swansea, Wales. At the time of its closing in 1917, the mine had reached a depth of 858 ft (260 m), with the better grade of ore having been exhausted. The total amount of ore produced up to 1917 was 51,972 tons (46,775 tonnes).

Early in the 1930s, C.H. Berggren sank a 49.5 ft (15 m) shaft on a new lead adjacent to the old mine at West Gore, but the vein was too narrow for economic recovery of the ore. In 1956 and 1957, the main shaft of the old workings was re-collared and the mine dewatered to the 200 ft (60 m) level. At this point, it was found that the shaft, level and slope openings had reduced in size to such an extent that further attempts to re-examine the mine were abandoned.

Mining History

Gypsum operations in the Windsor area, Nova Scotia around the turn of the century.

The steel works of the Steel Company of Canada at Londonderry, Nova Scotia (c.1880). The plant was capable of producing 29 500 to 49 500 tons (27 000 to 45 000 tonnes) of steel annually. The company is not related to the present-day Steel Company of Canada (STELCO). (Nova Scotia Archives photo.)

Malagash Salt Company surface plant at Malagash, Nova Scotia. This was the first rock salt mine in Canada (c.1927).

Tin

Although tin had been a recognized associate of identified ores of tungsten and molybdenum, it was never seriously considered for its economic potential in Nova Scotia until mineralized boulders containing tin were discovered by a Millmor Syndicate prospector at Plymouth, near Yarmouth, in the spring of 1976. Boulder prospecting and detailed geochemical soil surveys were carried out by Shell Canada Resources and extensive diamond drilling was completed in the East Kemptville area of Yarmouth County in 1977/78. Drilling in 1979/80 identified a large low-grade tin deposit.

Underground bulk sampling was completed in early 1981. Shell Canada Resources, Mineral Division, was disbanded in early 1982. The property was subsequently sold to Rio Algom of Canada, Ltd. who recently announced their intentions to put the deposit into production by late 1985. At least 61,600,000 tons (56,000,000 tonnes) of ore grading 0.16 per cent tin has been delineated.

Tungsten

Scheelite has mostly been found associated with gold occurrences and has been produced from only two properties in the Province. It was first mined at Moose River, from 1910 to 1918. Operations by Scheelite Mines Ltd. were intermittent

Mining History

One of several building stone quarries in the Wallace, Nova Scotia region. Stone from quarries such as this was used to build Government and Province Houses in Halifax.

Marble Mountain marble quarries, southern Bras d'Or Lake, Cape Breton Island (c.1890s). This was an important source for agricultural lime and building stone.

Reserve Mines colliery near Glace Bay. (Nova Scotia Archives photo.)

with total production of about 400 tons. In Lunenburg County southwest of Chester (Fig. 1), mining of a deposit at Indian Path began in 1927 and continued until 1929. During the early years of World War II, the critical condition of tungsten supplies led to the reopening of both the Moose River and Indian Path properties, but as the supply situation eased in 1943, these properties ceased production.

Manganese

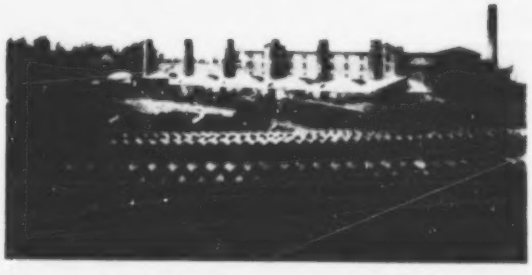
In 1876, manganese was first mined in the Tennycape area, about 40 miles (64 km) southwest of Truro. The mineral was produced intermittently for the next three decades from numerous small mining operations, with the Tennycape mine producing around 3993 tons (3630 tonnes) of manganese ore. Manganese was also mined to a relatively minor extent from the Loch Lomond district (general location of the former celestite mine; see Fig. 8) in Cape Breton around the turn of the century. North of Truro (Manganese Mines) and north of Halifax small manganese occurrences have been explored and some have been worked on a small scale.

Sporadic mining of manganese also took place at New Ross (Fig. 6) from 1891 to well within the present century. The Nova Scotia Manganese Company, the new Ross Manganese Company, and the International Manganese and Chemical

Mining History

Drilling on Sable Island by Mobil Oil in the late 1960s.

National Gypsum (Canada) Ltd. quarry, crusher and loading facilities at East Milford, Nova Scotia.



The brick, pipe and clay products plant of Standard Clay Products at New Glasgow, Nova Scotia. The clay came from nearby pits in the New Glasgow area.

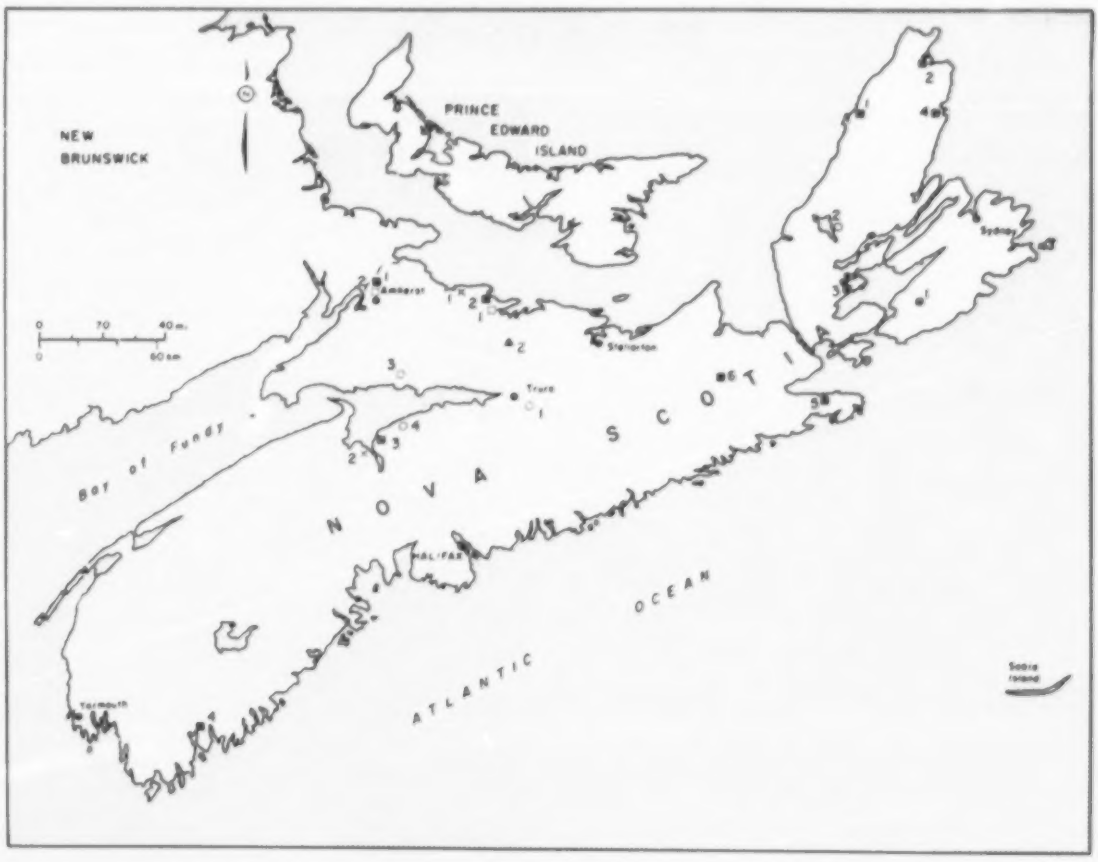
The conceptual drawing of the new Rio Algom Ltd. tin mine at East Kemptville, Nova Scotia. This open-pit operation is projected to begin in 1985. (Rio Algom photo.)

Company produced ore from the New Ross district between 1910 and 1921. In 1940 the property was leased to American interests and about 550 tons (500 tonnes) of manganese were mined before operations ceased. In 1942 the Geological Survey of Canada conducted a detailed exploration program in the area of the old mine workings as an emergency measure in search of strategic minerals. During the period 1958 to 1960, a new low-grade orebody in the New Ross district was investigated by Marpic Ltd. Investigations ceased pending more economic techniques in the metallurgical beneficiation of the low-grade ore.

Iron

One of the earliest recorded mineral discoveries in Nova Scotia was that of a minor occurrence of iron in Early Jurassic basalt at St. Marys Bay in 1604. However, it was not until the mid-1800s that iron became a commercial product and quantities of it were discovered and mined. During the nineteenth century, the mining of iron was moderately successful in Nova Scotia. Although it was important to the economy at the time, iron mining thereafter dwindled and ceased to exist by the beginning of the twentieth century.

The Nictaux-Torbrook deposits (Fig. 6) were first worked in



GYPSUM ⊠
1. Cheticamp
2. Dingwall
3. Cheverie
4. Ingonish

SALT □
1. Malagash
2. Amherst

CELESTITE ⊗
1. Enon

BUILDING STONE ■
1. Amherst (sandstone)
2. Wallace (sandstone)
3. Marble Mountain (marble)
4. Shelburne (granite)
5. Queensport (granite)
6. South River (diabase)

DIATOMITE ▲
1. Digby Neck
2. East New Annan

BARITE ○
1. Brookfield
2. Lake Ainslie
3. Five Islands
4. Walton

CLAY AND SHALE ×
1. Pugwash
2. Avonport

FIGURE 8. Former non-metallic mineral mining areas in Nova Scotia.

1829, and at Londonderry pockets of limonite were first mined in 1849 (Andreal, 1983). Between 1849 and 1906 iron ore was mined almost continuously at Londonderry and Torbrook, and minor operations were also undertaken at Bridgeville near Ferrona and in Cape Breton. The first charcoal furnace was erected at Londonderry in 1852 and the first steel mill in 1870. The latter was demolished in 1877 after unsuccessful attempts to manufacture steel of suitable quality. During the life of Nova Scotia's iron mines, four blast furnaces were in operation, two at Londonderry and one each at Nictaux and Ferrona near Bridgeville.

The ores at both Londonderry and Torbrook were principally hematite and limonite with ankerite ore at Londonderry being used as flux to take advantage of its iron content. The ores from Londonderry are considered to be part of a hypogene replacement origin (Weeks, 1948). The host rocks are green sandstones of the Canso Group (Late Carboniferous). The strataform iron deposit at Torbrook is Early Devonian in age. The Torbrook property was reopened early in the present century after a temporary shutdown and the ore was shipped to Londonderry to mix with that ore in the furnace. When the blast furnaces at Londonderry ceased operations in 1908 production from the Torbrook property also necessarily stopped.

Some of the iron deposits in the Province could still produce considerable tonnage except that they contain excessive amounts of silica, sulphur and phosphorous. With the discovery and mining development of the iron ore in the Lake Superior region around 1877 and then the Bell Island, Newfoundland, iron deposit in the 1890s, Nova Scotia iron production ended.

Industrial Minerals

Gypsum

Gypsum ranks next to coal in importance and has helped to form a stable environment for the mineral industry in Nova Scotia.

During the years 1861 to 1867, twenty-five ports in Nova Scotia were shipping gypsum to the United States. A few of the

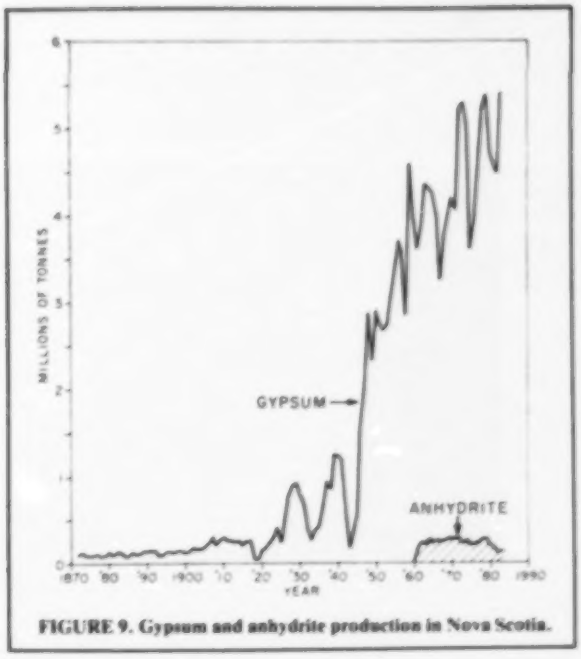


FIGURE 9. Gypsum and anhydrite production in Nova Scotia.

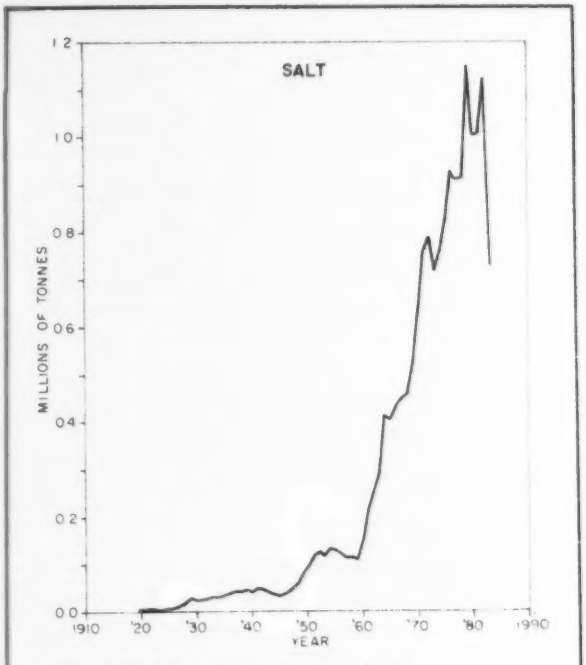


FIGURE 10. Salt production in Nova Scotia.

producing sites are shown on Figure 8. With very few exceptions, the producing properties were controlled by United States' interests. The corporate development of the Nova Scotia gypsum industry has been complex, with numerous openings and closures of quarries, mergers and absorptions by old and new companies. The over-all trend has been to develop large companies interested in having a captive source of raw material. Nova Scotia has very large gypsum reserves sufficient to supply a greatly expanded industry.

The vast bulk of current production is shipped in its original state to the eastern seaboard of the United States by subsidiaries of three major United States companies, namely United States Gypsum, National Gypsum, and Georgia Pacific, operating quarries in Windsor, Little Narrows, Milford, and River Denys, respectively.

Until shortly before World War II, only the white variety of gypsum was quarried. Its chief use was in the manufacture of plaster for the construction trade. After the war, the gypsum industry experienced an unprecedented increase in the demand for its products (Fig. 9), and production levels increased dramatically with the advent of the use of gypsum wallboard in building construction.

So closely is the gypsum industry allied with the building trade that the welfare of that trade virtually controls the welfare of the Nova Scotia industry. After the stock market crash in 1929 and during the Second World War, the production of gypsum in Nova Scotia was virtually halted. The building boom of recent years rocketed production (Fig. 9) to current levels approximating 6 million tons (5.4 million tonnes).

Anhydrite, which is closely associated with gypsum, has until recent years been a hindrance to gypsum operations. Its unwelcome appearance in a gypsum quarry frequently caused cessation of operations. Recent use of anhydrite as a retarding agent in the cement industry, and as a soil conditioner in peanut growing has been responsible for raising the production to more than 220,000 tons (200,000 tonnes) per year.

Salt

Great thicknesses of salt occur in virtually every major Carboniferous sedimentary basin in Nova Scotia. One deposit at Mabou on the west coast of Cape Breton has a vertical thickness of 4000 feet (1220 m). In south-central Nova Scotia, the Shubenacadie Basin alone is estimated to contain 33 billion tons (30 billion tonnes) of rock salt in stratigraphic thicknesses reaching 1000 feet (300 m).

Although attempts were made as early as 1813 to mine salt in Nova Scotia, it was not until 1918 that the first rock salt mine in Canada was opened by the Malagash Salt Company at Malagash (Fig. 8). When operations became uneconomical because of depth and haulage conditions in 1956, the company transferred activities to its newly-discovered deposit at Pugwash where it became known as The Canadian Rock Salt Company. The company expanded with the building of a modern multi-million dollar evaporator plant, marking the beginning of a rapid increase in salt production (Fig. 10).

In 1946, brining operations were begun on a huge deposit of salt discovered at Nappan, Cumberland County, during previous exploratory diamond drilling for gypsum and confirmed later by a nearby drilling program for petroleum. At present, this property, owned by Domtar Chemicals Ltd., Sifto Salt Division, is producing many types of high-quality evaporated salt products. Combined annual production from the Pugwash and Nappan operations exceeds one million tonnes and is utilized in numerous phases of the dairy, transportation, hide curing, refrigeration, fishing, chemical and processing industries, and especially as domestic salt.

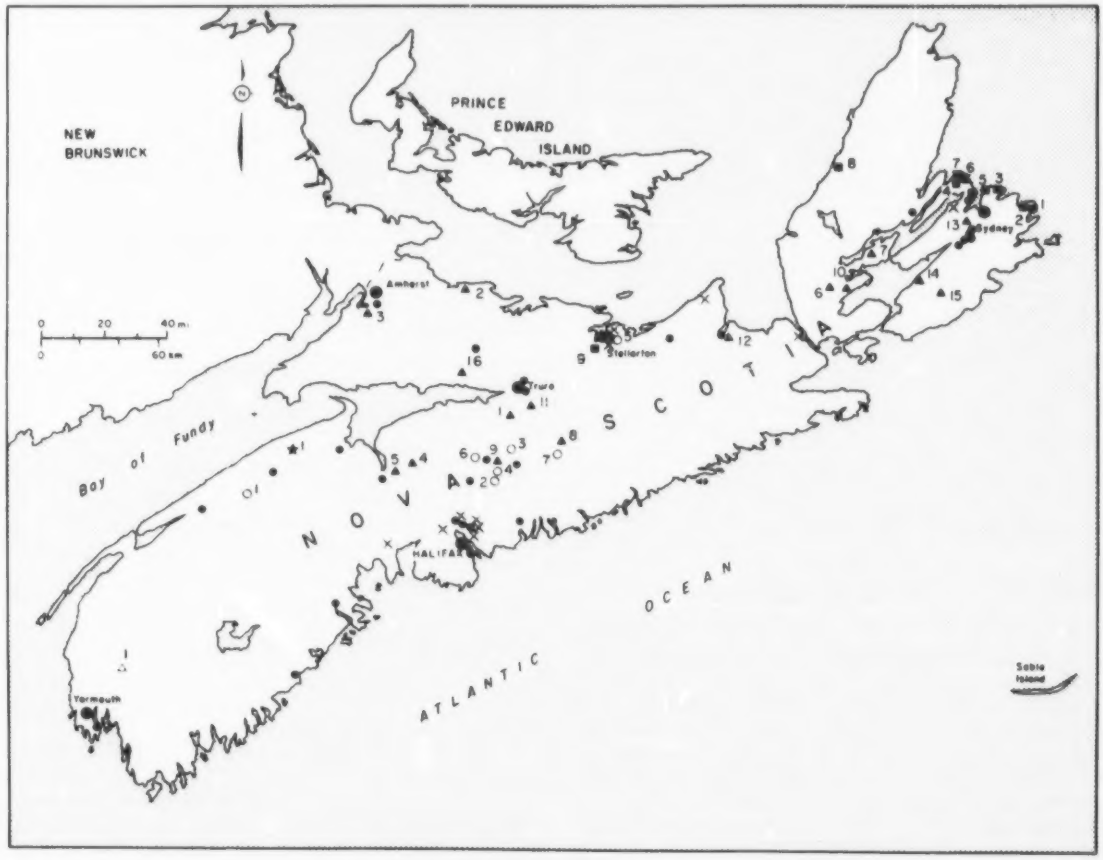
Exploration for both commercial salt and underground gas storage in solution salt caverns has been undertaken throughout the Province, with particular interest in the Canso Strait area.

Potash

In recent years interest has increased in the possibilities of potash occurrences in the Province, particularly in association with the salt deposits. Recent work in the Cumberland (north of the Cobequid Highlands) and River Denys Basins (southwest end of Bras d'Or Lake) has identified interesting quantities of potash.

Limestone and Dolomite

Limestone and dolomite have been quarried continuously in Nova Scotia for well over 100 years. Production began on a small scale, usually seasonally, to supply stone for the numerous lime-burning kilns operating in the Province. Most of the burnt lime was used locally for agricultural purposes,



CURRENT MINING LOCATIONS

COAL ■
1. Donkin Mine (CBDC)
2. No. 26 Colliery (CBDC)
3. Lingan Mine (CBDC)
4. Prince Mine (CBDC)
5. Selminco Inc.
6. Novaco Ltd.
7. T. Brogan & Son Construction Ltd.
8. Evans Coal Mine Ltd.
9. Drummond Coal Company Ltd.

STRUCTURAL MATERIALS ○
1. Heritage Memorials Ltd. (granite)
2. L.E. Shaw Ltd. (clay)
3. L.E. Shaw Ltd. (clay)
4. L.E. Shaw Ltd. (shale)
5. L.E. Shaw Ltd. (shale)
6. N.S. Sand & Gravel Ltd. (silica sand)
7. N.S. Sand & Gravel Ltd (silica sand)

LARGE SAND AND GRAVEL PRODUCERS •

LARGE CRUSHED ROCK PRODUCERS X

INDUSTRIAL MINERALS ▲
1. Canada Cement Lafarge Ltd. (cement, limestone)
2. Canadian Salt Co. Ltd. (salt)
3. Domtar Chemicals Group (salt)
4. Domtar Construction Ltd. (gypsum)
5. Fundy Gypsum Company Ltd. (gypsum)
6. Georgia-Pacific Corp. (gypsum)
7. Little Narrows Gypsum Company Ltd. (gypsum, anhydrite)
8. Mosher Limestone Ltd. (limestone, dolomite)
9. National Gypsum (Canada) Ltd. (gypsum)
10. N.S. Sand & Gravel (marble)
11. Nystone Chemicals Ltd. (barite)
12. Ridge Brokers Ltd. (limestone)
13. Scotia Limestone Ltd. (limestone)
14. Scotia Limestone Ltd. (limestone)
15. Novex Mining & Exploration Ltd. (barite)
16. Magcobar Division, Dresser Canada Inc. (barite)

METALLIC △
1. Rio Algom Ltd. (tin)

PEAT MOSS ★
1. Annapolis Valley Peat Moss Co.

FIGURE 11. Location of producing mines and quarries in Nova Scotia.

although a small export market developed on Prince Edward Island. By 1851, over 11,660 tons (10,600 tonnes) of limestone were burned in Nova Scotia and by 1875 lime-burning businesses were well established in several areas. The most important of these were located at Pugwash in northern Nova Scotia; Marble Mountain, and George's River in Cape Breton Island.

About the same time the lime-burning industry began to

flourish, iron mines were opening at Londonderry, Ferrona, and Nictaux-Torbrook in the Annapolis Valley (see Fig. 6). Iron mining led to steel making, requiring limestone and dolomite as fluxing agents. In 1895 the Bras d'Or Marble Co. began work on the Marble Mountain deposit to produce a high-quality marble building stone in addition to burnt lime and fluxing stone already produced by the Dominion Iron and Steel Co. The flux stone was shipped to the steel plant in Sydney. This quarry operated on a large scale until 1920.

On mainland Nova Scotia, The Eastern Lime Company operated quarries, limestone calcining and hydrating plants at Windsor. In 1930 Mersey Paper Company opened a limestone quarry on the coast southwest of Halifax to supply limestone to its paper mill at Liverpool. A new quarry, operated jointly by the Department of Highways and the Department of Agriculture, was opened at Pugwash in 1932 for the production of limestone for surfacing highways and for agricultural purposes. In 1934 the Department of Agriculture established a small grinding plant at the Dominion Steel and Coal Corporation's quarry at Point Edward (Sydney area) to produce agricultural limestone.

Along with these major quarries, up to fifteen other limestone and dolomite quarries were operating in the Province mostly to supply ground stone for agricultural purposes.

In 1940, O.P. Mosher opened a dolomitic limestone quarry at Upper Musquodoboit to produce agricultural lime and to supply Sydney Steel with stone for refractory uses. In 1963 Mosher Limestone began production of limestone from a deposit at Irish Cove and dolomite from a deposit at Frenchvale, both in Cape Breton. Production is now from the Upper Musquodoboit quarry but will be augmented soon by a new quarry near Halifax.

A new company, Scotia Limestone, was formed to operate the Cape Breton deposits and later this company was purchased by Sydney Steel. Scotia Limestone presently operates a limestone quarry at Irish Cove and a dolomite quarry at Frenchvale (Fig. 11) to supply stone to the steel plant.

In 1966 development work began on a limestone deposit at Southside Antigonish Harbour to supply the Scott Maritimes paper mill at Abercrombie Point, west of Stellarton. Ridge Brokers Ltd. presently owns and operates this quarry to meet the limestone requirements of the Scott Maritimes paper mill.

At present most of the limestone quarried in Nova Scotia is used for the production of cement by Canada Cement Lafarge which operates a quarry adjacent to its plant at Brookfield, Colchester County. This plant, construction of which began in 1964, produces most of the cement used in Nova Scotia and has shipped cement to other Maritime region markets.

Barite and Fluorite

Barite production in the Province started at the Eureka Mine near Five Islands, west of Truro in 1865 (Fig. 8). Over the next decade 3,000 tons (2,700 tonnes) of barite were produced. Barite production here was the first in Nova Scotia and probably the first in Canada (Spence, 1922). The first specific account of the mining of barite was in 1896 from the Lake Ainslie district in Cape Breton Island. The ore from these workings were taken by horse-drawn wagons to Whycocomagh and shipped by water to the paint plant of Brandram Henderson in Halifax. Between 1904 and 1916, barite was produced almost continuously from a number of deposits situated along the eastern shore of Lake Ainslie, western Cape Breton Island.

In 1940, a barite showing near Walton, Hants County, was drilled and eventually proved to be one of the largest single deposits of barite in the world. Production by Canadian Industrial Minerals Ltd. began in 1941 from an open-pit mine, later converted to an underground operation. Purchased in 1955 by Magnet Cove Barium Corporation, a subsidiary of Dresser Industries Inc., the mine continued operations until 1971, averaging a production of 99,000 tons (90,000 tonnes) annually, which was 90 per cent of the barite production in Canada. Due to the flooding of the mine, production was maintained from minor recovery operations in the upper mine levels and the open-pit area until mine closure in 1979.

In 1944, Canadian Industrial Minerals Ltd. started diamond drilling at Brookfield (Fig. 8). The property was transferred to Maritime Barytes Ltd. in 1948 and further exploration led to the erection of a mill for production of ground white barites. The plant had operated for only a short time when metallurgical difficulties and failure to meet market specifications caused it to close. This mine was reopened in 1979 as a pharmaceutical barite producer by Nystone Chemicals Ltd., and in the first three years of operation has produced slightly more than 990 tons (900 tonnes) of high-grade barite for the pharmaceutical market.

Most recently, Novex Mining and Exploration Co. Ltd has outlined a barite deposit at Pine Brook near Loch Lomond in southeastern Cape Breton (Fig. 11) and began production of barite to supply the offshore drill mud market in May of 1983. Reserves of 176,000 tons (160,000 tonnes) of barite have been proven at Pine Brook.

Associated with the barite occurrences at Lake Ainslie, Cape Breton, particularly in the southern portion of the district, is the mineral fluorspar or fluorite. It occurs as an intimate mixture of barite-fluorspar-calcite from which, in the 1930s, test lots of hand-cobbed ore from the Trout River area were shipped to the steel plant in Sydney. Hand-cobbing failed to meet specifications for quality, and as separation tests in Ottawa revealed successful separation only at costs above the economic limit, the operation closed down. In 1965 and 1966, a diamond drilling program in the East Lake Ainslie area indicated reserves of 3.3 million tons (3 million tonnes), averaging 45 per cent barite and 17.36 per cent fluorite. More recent estimates by Conwest Ltd., who currently holds the Trout River property, indicate reserves of 4.5 million tons (4.1 million tonnes) of ore, grading 33 per cent barite and 17 per cent fluorite. Assessment of the deposit is continuing.

Celestite

The major occurrence of celestite, a strontium ore, in the Province is in the Loch Lomond area of Cape Breton (Fig. 8). In 1963, a celestite deposit was discovered at Enon Cape Breton County, just north of Loch Lomond. Surface work and diamond drilling outlined celestite reserves of approximately 1,650,000 tons (1,500,000 tonnes) with grades varying from 30 to 60 per cent. A plant capable of producing strontium carbonates was established by Kaiser Celestite and production was achieved in 1971. The mine closed in 1975 due to loss of markets for strontium in the television (picture tube) industry, and the failure of anticipated market development in the ferromagnet industry.

Recent interest has been expressed in using the Cape Breton celestite orebodies as a source of strontium metal. Reactivation of celestite production would serve to diversify the industrial mineral base and possibilities for renewed production which are being actively pursued by the Province.

Structural Materials

Aggregate Resources

Aggregate resources include primarily materials used in the construction industry, such as sand and gravel, crushed stone, and clay and shale used in brick manufacturing. Silica sand is also included under this broad heading. The value of aggregate production at Nova Scotia in 1982 was second only to coal and higher than gypsum or salt (Tables 7, 8).

Aggregates. The mining of aggregate materials goes back to the early history of the Province, when sand and gravel and rock were required to build fortifications, wharves, roads and dwellings. Early aggregate mining was confined to deposits along stream courses and all easily accessible land-based deposits. Very little is known about the early development of the aggregate resource industry in Nova Scotia. The first mention of aggregate activity does not appear in the Provincial Mines Reports until 1925 when summaries of the activities of

TABLE 7. Industrial minerals production in Nova Scotia, 1983

Company	Location	Production (tons)	Production (tonnes)	Total[1] Number Employed	Approximate Value[2]
Gypsum					
Fundy Gypsum Co. Ltd.	Miller Creek, and Wentworth Creek, Hants County	1 437 540	1 306 855	161	
Little Narrows Gypsum Co. Ltd.	Little Narrows, Victoria County	815 995	741 814	76	
Domtar Construction Materials Ltd.	Windsor, Hants County	8 903	8 094	12	
National Gypsum (Canada) Ltd.	Milford, Halifax County	2 853 882	2 594 438	111	
Georgia Pacific Corp.	River Denys, Inverness County	827 511	752 283	41	
Canada Cement Lafarge, Ltd.	Upper Brookfield, Colchester County	4 991	4 537	see limestone	
	TOTAL (gypsum)	5 948 823	5 408 021	401	$ 37 097 027
Anhydrite					
Fundy Gypsum Co. Ltd.	Miller Creek, and Wentworth Creek, Hants County	76 403	69 457	included in	
Little Narrows Gypsum Co. Ltd.	Little Narrows, Victoria County	43 285	39 350	gypsum	
	TOTAL (anhydrite)	119 688	108 807	—	$ 734 441
Salt					
Canadian Salt Co.	Pugwash, Cumberland County	726 440	660 400	205	
Sift Salt Division Domtar Chemical Group	Nappan, Cumberland County	70 780	64 345	85	
	TOTAL (salt)	797 220	724 745	290	$ 31 692 290
Limestone					
Ridge Brokers Ltd.	Southside Harbour, Antigonish County	13 750	12 500	3	
Canada Cement Lafarge Ltd.	Brookfield, Colchester County	331 978	301 798	12	
Scotia Limestone Ltd.	Irish Cove, Cape Breton County	55 000	50 000	13	
Mosher Limestone Ltd.	Upper Musquodoboit, Halifax County	103 590	94 173	36	
N.S. Sand & Gravel Ltd.	Marble Mountain, Inverness County	nil	nil		
	TOTAL (limestone)	504 318	458 471	64	$ 3 845 586
Dolomite					
Scotia Limestone	Frenchvale, Cape Breton County	—	—	—	—
Barite					
Nystone Chemicals Ltd.	Brookfield, Colchester County	9 095	8 268	27	
Novex Mining and Exploration, Ltd.	East Bay, Cape Breton County	14 598	13 271	22	—
Magcobar Division, Dresser Canada Inc.	Bass River, Colchester County	1 540	1 400	4	
	TOTAL (barite)	25 233	22 939	53	$ 1 088 650[3]
	Total for Industrial Minerals	7 395 281	6 722 983	808	$ 74 457 994

[1] Total employees: mining, production, clerical, supervisory, etc.
[2] Estimate from Nova Scotia Department of Mines and Energy sources
[3] Processed or manufactured value

two aggregate quarries operating in Halifax County were published.

At present, production of construction materials is from glaciofluvial deposits and/or rock quarries depending upon the local availability of resources. Included in this industry are the permanent, usually large-volume construction material producers, intermittent operators working on a seasonal basis, road builders, ready mixed concrete producers and some government departments. Not only do these operations supply all the provincial construction material requirements but an export business has developed shipping materials to Prince Edward Island, Iles-de-la-Madeleine, and Bermuda.

Clay and Shale. Local deposits of clay and shale have been worked for well over 100 years to supply structural clay products, manufacturers and pottery shops. In the past, brickyards operated in all inhabited regions of the Province while much larger plants producing bricks, drainage pipes, flue liners and other products were found in some of the larger centres. In 1910 there were twelve brickyards in the Province but at present there is one, L.E. Shaw Ltd. at Lantz, (north of Halifax), producing virtually all the brick used in Nova Scotia.

The most significant clay deposits in the Province are of Early Cretaceous and Pleistocene age. The Pleistocene deposits are non-refractory but are suitable for the manufacture of structural clay products and pottery. The Cretaceous deposits grade from low-duty to high-duty refractory clays.

Silica Sand

The need for moulding sand by the many foundries operating in the Province led to the early development of several sand deposits. Although many sand deposits were used, only two are actually silica sand deposits. These are the River Denys Sand and Clay Co. Ltd. deposit at Diogenes Brook (Melford west of Bras d'Or Lake, Cape Breton) and the Belmont (west of Truro) deposit. The Melford deposit was productive from 1910 to 1924 and again in 1943 and 1944. Moulding sands produced went to the steel plants in Sydney and Trenton. The Belmont deposit has produced silica sand intermittently since 1908 for a variety of uses including moulding sand, industrial sand and as an additive in cement making.

Along with the production of silica sand, the steel plant in Sydney obtained silica from quartzite deposits at Leitches Creek, Sydney area, from 1921 to 1944 and at Chegoggin Point, Yarmouth area, intermittently from 1945 to 1963. This quartzite was ground and used to make silica brick, silica cement and sometimes mixed with clay to make fine brick.

TABLE 8. Structural materials and miscellaneous materials production in Nova Scotia, 1983

Company	Location	Production (tons)	Production (tonnes)	Total[1] Number Employed	Approximate Value[2]
Clay					
L.E. Shaw Ltd.	Lantz, Halifax County	22 154	20 140	64	
	Shubenacadie, Halifax County (number of bricks manufactured is million)	—	—	—	
Shale					
L.E. Shaw Ltd.	Milford, Hants County New Glasgow, Pictou County	21 954	19 958	included in above	
	TOTAL (clay and shale)	44 108	40 098	68	$ 661 617[3]
Silica Sand					
Nova Scotia Sand and Gravel Ltd.	Nine Mile River, Hants County	16 500	15 000	8	$ 420 000[3]
Sand and Gravel					
46 Producers	Province-wide	8 097 284	7 361 167	599	$ 30 696 066[3]
Aggregate (Quarried)					
11 Producers	Province-wide	3 414 879	3 104 435	162	$ 15 429 041[3]
Dimension Stone					
Heritage Memorials Ltd.	Quarry: Nictaux, Annapolis County Plant: Windsor, Hants County	6 000 ft.^{3}	180m^3	24	$ 36 000
Arsenault Monument Works Ltd.	Quarry: Loch Katrine, North Grant Antigonish County Plant: Antigonish, N.S.	—	—	8	$ 36 000
	TOTAL	6 000 ft.^{3}	180m^3	32	$ 36 000
Peat Moss					
Annapolis Valley Peat Moss Company	Berwick, Kings County	288 811 (4 ft.^{3} per bale)		105	$ 1 600 866[3]
	TOTAL (Structural Materials and Misc.)			974	$ 48 843 590

[1] Total number of employees including office, clerical, supervisory, mining and production
[2] Estimate from Nova Scotia Department of Mines and Energy sources
[3] Processed or manufactured value

Although quartzite deposits are extensive in the Province, their lower silica content restricts their usage to aggregate purposes.

Small quantities of white quartz have been quarried from time to time from large quartz veins. Most of this stone was used as exposed aggregate material by manufacturers of pre-cast concrete building panels.

Building and Dimension Stone

The use of stone in the construction industry is largely of historic significance in Nova Scotia, with very little present production, limited mainly to facing stone supplied intermittently on demand.

The red and grey, Late Carboniferous sandstones north of the Cobequid Highlands have been the principal source of dimension stone. Quarries at Amherst and along the Wallace River (Fig. 8) provided building stone for the Province House and the Government House in Halifax (Parks, 1914) and many other buildings in Nova Scotia beginning in the early part of the nineteenth century.

Several granite quarries in Halifax and vicinity and in the South Mountain Batholith of southern Nova Scotia supplied dimension stone for buildings in the Province.

Oil and Natural Gas

Onshore

Exploration for hydrocarbons in the Province began in the mid-1800s when surface seeps, oil-filled cavities in gypsum, oil shales and petroliferous sandstones were discovered in several locations in the Province. Numerous accounts have been recorded in the literature (Bell, 1958).

Various drilling programs have encountered subsurface natural gas, sandstones and limestones with strong petroliferous odours and gypsum with oil in vugs and cavities. None of the discoveries have been commercial, although there is a report of approximately 100 gallons of oil from a hole near MacIsaacs Point at Lake Ainslie in 1864.

Onshore, approximately 20 wells have been drilled for petroleum during the past 25 years by companies such as Anschutz, Chevron/Irving, Gulf, Imperial Oil, and Corkan. During the past year, interest in the major basins of Nova Scotia increased with programs involving mapping, seismic acquisition, and sample analysis. Other companies have been looking with interest in the Minas Basin, Cumberland Basin and several other areas in Cape Breton.

A Chevron Canada Ltd. and Irving Oil Ltd. joint venture drilled several holes in the Bras d'Or Lake - Malagawatch area in late 1979. The holes are listed as dry and abandoned. In the Bras d'Or No. 1 well, however, during a bottom hole drill-steam test, 22 m of mud cut oil was brought to surface.

Chevron, also in partnership with Irving, drilled a recent onshore hole, Scotsburn No. 2, at a location about 20 miles (32 km) west of Stellarton. It was completed in November 1981 to a total depth of 8560 feet (2593 m) and was classed as a dry and abandoned well.

Chevron undertook a regional seismic program early in 1983 and is currently reviewing its data from the Minas Basin, Cumberland Basin (south and north of the Cobequid Highlands, respectively) and Cape Breton Blocks.

During 1982 and 1983, a number of companies including Tricentrol, Sigma, MEX, and Norvar were involved in

geological reconnaissance mapping, aerial photo interpretation, research and sample analysis.

Offshore

Following the large discovery of oil in Leduc, Alberta, in 1947, petroleum exploration intensified in western Canada. In the late fifties, industry broadened its search for petroleum to new areas and the continental shelf off Nova Scotia (Scotian Shelf) came to be considered an exciting prospect. In 1959, Mobil Oil undertook an air magnetometer survey of the Sable Island area. The following year, the company carried out its first seismic program and acquired approximately 1000 km of data on and around the Sable Island area. In 1963, Shell Canada licensed approximately 20,015,500 acres (8.1 million ha) from the Province. By early 1965, some 35,583,100 acres (14.4 million ha) on the Scotian Shelf were licensed to other companies. During the early part of the 1970s, the area under license extended onto the slope, where water depths are greater than 600 feet (200 m).

The area currently held by oil companies offshore Nova Scotia exceeds 35.2 million acres (6.07 million ha); of this, 11.6 million acres (4.7 million ha) are under moratorium due to international boundary disputes. Some 7 million acres (3.2 million ha) are held under provincial license onshore Nova Scotia.

In the offshore area, exploration drilling started in 1967 with the Mobil C-67 well on Sable Island. This was followed in September 1969 by Shell Canada Limited, which contracted the semi-submersible drilling unit, Sedneth 1, to drill on the Scotian Shelf. By the end of May 1984, 90 wells had been drilled in the Province's offshore area by a number of companies including Chevron, Mobil, Murphy, Petro-Canada, Shell, Union, Home Oil and Husky/Bow Valley. Of the 90 wells drilled offshore, 14 are classified as significant discoveries (11 gas) including two recent wells drilled on the Glenelg and Uniacke structures. As of June 1984, four semi-submersible drilling units and four jack-up rigs were actively drilling offshore Nova Scotia. The rigs are drilling in the general vicinity of Sable Island and are concentrating on the geopressured area. The current estimate (1983) by the Geological Survey of Canada for total gas reserves offshore of Nova Scotia shows a 50 per cent probability that 17.9 trillion cubic feet (508 billion m^3) could exist on the Scotian Shelf. In the Venture area the reserves of natural gas are currently estimated at 2.5 trillion cubic feet (75 billion m^3). Further delineation and exploration drilling is taking place on the Venture Field and other new gas discoveries in the Sable Island region.

Present-Day Mining Activities

Introduction

Nova Scotia has 88 operating mines and quarries. These mines employ a total of 6418 people which includes production and mill workers as well as associated clerical, technical, and supervisory personnel. The Nova Scotia Department of Mines and Energy estimates the total value of mineral production in 1984 to be $290.7 million. The locations of the operating mines are shown on Figure 11. The production information is contained in Tables 6, 7, 8.

Metallic Minerals Mining

Rio Algom Limited is preparing the site for their tin mine north of Yarmouth (Fig. 11). The operation will be an open pit with the ultimate dimensions being approximately 1650 feet by 5600 feet by 430 feet deep (500 m by 1700 m by 130 m deep). The mill, ore storages areas, and other associated buildings are scheduled for completion in late 1984. Mill start-up time is set for late fall or winter of 1985.

Tin is the primary product with copper, zinc and silver as by-products. The mine will produce an average of 4800 tons (4400 tonnes) of tin concentrate, 1650 tons (1500 tonnes) of copper concentrate, and 2640 tons (2400 tonnes) of zinc concentrate over the first decade. The mill is designed for an output of 9900 tons (9000 tonnes) per day.

Coal Mining Operations

In 1983, there were five producing underground coal mines, two open-pit coal mines and one coal dump reclamation plant (Fig. 11; Table 6). Under active development were one underground coal mine, one open pit, and one coal dump reclamation plant. The estimated value of coal produced in 1983 is $167.4 million, twice as much as all industrial mineral production. Production totalled 3.5 million tons (3.2 million tonnes).

The Cape Breton Development Corporation (CBDC), a federal crown corporation, operates three coal mines in the Sydney region of Cape Breton: the Prince Mine at Point Aconi, No. 26 Colliery at Glace Bay, and the Lingan Mine at Lingan. The No. 26 Colliery was prematurely closed in 1984 due to fire. Coal is sold to the Nova Scotia Power Corporation, exported to various countries, and sold for coking at the Sydney Steel Company. Another mine, the Donkin Mine, is under development by CBDC at Donkin, east of Glace Bay. It is expected to begin production in the late 1980s. The total production of the CBDC mines is 3.1 million tons (2.8 million tonnes).

The Drummond No. 2 mine, recently purchased by the Pioneer Coal Company, is located near the town of Westville, Nova Scotia. Coal is mined from the lower part of the Stellarton Group of Late Carboniferous age. The entire output of the Drummond Mine is gained by the room-and-pillar method of mining and is sold to the Nova Scotia Power Corporation as thermal coal for a nearby generating unit. Total production in 1983 was 13,900 tons (12,640 tonnes).

The Saint Rose Colliery, Inverness County, is owned and operated by Evans Coal Mines Ltd. The entire output is produced by room-and-pillar system of mining with the use of slushers. Coal from the mine is sold to the Nova Scotia Power Corporation and for domestic use. During 1983, 47,900 tons (43,540 tonnes) were produced from strata of the Riversdale Group of Late Carboniferous age. Currently a diamond drilling program was started to define more reserves.

T. Brogan and Son Construction Ltd. operates two strip mines at Point Aconi, Cape Breton. Site No. 1 is at Big Head and Site No. 2 is at Table Rock. The overburden is removed by scraper and bulldozer and the exposed coal is ripped with a bulldozer and loaded into trucks with a front-end loader. Coal is sold to CBDC. During 1983, 33,901 tons (30,819 tonnes) of coal were produced.

Novaco, a Provincial crown corporation, owns the Point Aconi strip mine but the actual mining is carried out under contract by Nova Construction Co. of Antigonish. The overburden is drilled, blasted and removed by a dragline excavator. The exposed coal seam is loaded into trucks with a small shovel. Novaco produced 236,456 tons (245,779 tonnes) of coal in 1983.

Selminco Inc. operates one coal reclamation plant working the Princess Mine dumps, near North Sydney and is developing a further plant which will reclaim dumps in the Scotchtown area, northeast of Sydney. The reclaimed coal is sold to CBDC.

Pentum Mining and Exploration has been issued a special license to conduct underground testing to determine the mining feasibility of the Rodney Seam in Springhill.

Industrial Minerals

The production of industrial minerals, which includes gypsum, anhydrite, salt, limestone, dolomite, and barite, has a value of $74.4 million (Fig. 11; Table 7). Over eight hundred people are employed in the industry. This includes all production personnel as well as associated clerical, technical, and supervisory personnel.

All of the industrial minerals produced in Nova Scotia, with few exceptions, are from the Early Carboniferous Windsor Group. The Windsor Group is confined to basins in central

and northern Nova Scotia and Cape Breton Island. Large reserves of gypsum, salt, anhydrite, and limestone are contained in this unit.

Only three occurrences are not in the Windsor Group. Two barite occurrences, Brookfield and Bass River (Fig. 11), are replacement deposits in faulted areas. The limestone quarry of Nova Scotia Sand and Gravel Ltd. at Marble Mountain is operated in marble of the Precambrian George River Group.

Gypsum

Domtar Construction Ltd. operates a small gypsum quarry at MacKay Settlement which produced 8,903 tons (8,094 tonnes) in 1983. The actual quarry operation is done under contract by D. MacDonald. Domtar is the only gypsum operation in the Province that undertakes any processing of the crude gypsum. The gypsum produced is calcined at a plant in Windsor, Nova Scotia, for use as plaster of Paris and dental plaster.

The Fundy Gypsum Company Ltd. quarries and plants are located in the Wentworth and Miller Creek areas near Windsor, Nova Scotia, while the shipping facilities are located at Hantsport, Nova Scotia. Selective quarry mining using truck and shovels is used to produce gypsum and anhydrite. The materials are crushed and transported via unit train to ship-loading facilities at Hantsport for shipment to wall board manufacturing plants in the United States. Two quarries are in operation: Wentworth, which produces anhydrite and gypsum, and Miller Creek, which produces gypsum only. The company produced 1,437,540 tons (1,306,855 tonnes) of gypsum and 76,403 tons (69,457 tonnes) of anhydrite in 1983.

Georgia-Pacific Corporation operates a quarry situated at River Denys (Fig. 11). The gypsum is transported by rail to ship-loading facilities at Port Hastings for shipment to wall board manufacturing plants. At the quarry the overburden is stripped by a dragline excavator and the gypsum is recovered by shovel and truck. During 1983, 2,853,882 tons (2,594,438 tonnes) of gypsum were mined.

Little Narrows Gypsum Company Ltd. operates a gypsum and anhydrite quarry at Little Narrows with ship-loading facilities at the Bras d'Or Lake. This operation started in 1936 and is the oldest gypsum quarry operating in the Province. The anhydrite is shipped to cement plants and to the southern United States for use as a soil conditioner. The gypsum is used both for wall board manufacturing and cement making. The company produced 815,995 tons (741,814 tonnes) of gypsum and 43,285 tons (39,350 tonnes) of anhydrite.

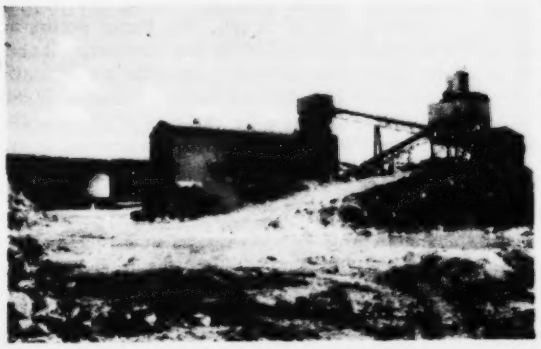
National Gypsum operates the largest gypsum quarry in the Province at East Milford and a ship-loading facility at Wright's Cove, Halifax - Dartmouth area. Unit trains transport the gypsum from the quarry to dockside from where it is shipped to east coast United States markets for the manufacturing of wall board and cement. A total of 2,853,882 tons (2,594,438 tonnes) of gypsum was produced during 1983.

Salt

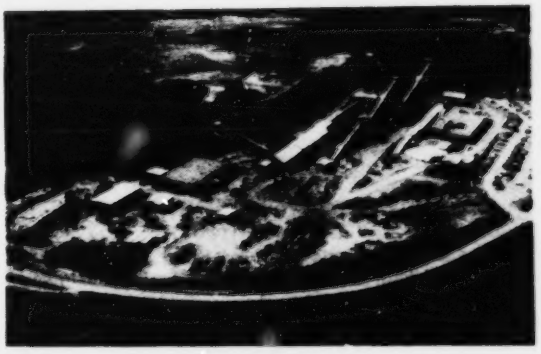
The Canadian Salt Co. Ltd. operates the Pugwash Mine which is located in Pugwash. A room-and-pillar system of extraction is employed utilizing trackless diesel equipment. All production is gained from the 255 m level. In this system of extraction the working faces are first undercut and then blasted and loaded by front-end loaders onto trucks for transportation to a central underground crushing station. Once crushed, the salt is then skip-hoisted and fed to the processing plant on surface. This plant produces industrial grades, blocks for farm use, and refined salt for domestic consumption. The industrial grades are either supplied in bulk for truck transportation, bagged for rail transportation, or transported in bulk or bag to storage and shiploading facilities at the Pugwash Harbour wharf.

Domtar Chemicals Group, Sifto Salt Division, operates a solution salt mine located at Nappan south of Amherst. Water is pumped down to the deposit dissolving the salt and the brine is then forced back to the surface where the salt is extracted using the "vacuum pan" process. The products are used for various domestic and industrial purposes.

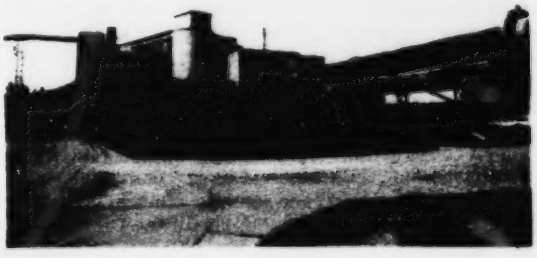
Mining History



Kaiser Celestite mill at Lake Enon, Cape Breton (c.1972). The open pit was a short distance away from the Windsor Group carbonates. The celestite was found as a replacement mineral.



The Lingan Mine of the Cape Breton Development Corporation.



The kiln and cement plant of Canada Cement Lafarge Ltd. at Brookfield, Nova Scotia.

Barite

Nystone Chemicals Ltd. operates the mine at the reactivated Brookfield barite deposit. The ore is mined using open-pit methods crushed, and jigged by a contractor who transports it to the Debert Air Industrial Park for treatment in the company-owned mill. The barite concentrate is leached and ground to a fine powder and is sold for pharmaceutical use. The Company is investigating the feasibility of diversifying into the production of drill mud grade barite.

Novex Mining and Exploration Ltd. operates an open-pit mine for barite in the Loch Lomond area of southeastern Cape Breton. The stratabound deposit was formed by the replace-

ment of a limestone bed in the Windsor Group. The production of the mine is milled nearby at the former Kaiser Celestite/Yava mill and is sold as drilling mud barite used in offshore drilling.

Magcobar Division, Dresser Canada Inc. has a barite operation at Bass River, west of Truro. The barite occurs as a replacement in brecciated sandstones and conglomerates adjacent to major faults. The open pit is operated under contract by Mosher Limestone Ltd. and the barite is milled at Walton. The barite is used as drilling mud barite in offshore drilling. Magcobar has recently been issued a lease to mine barite from the waste dumps at the former Walton mine.

Limestone and Dolomite

Canada Cement Lafarge Ltd. operates a limestone quarry at Brookfield, Colchester County, where the total production from the quarry is processed by an on-site cement manufacturing plant, owned and operated by the company. The company also operates an industrial sand pit in Belmont, west of Truro. Limestone production during 1983 was 331,978 tons (301,798 tonnes).

Mosher Limestone currently supplies most of the agricultural limestone used in Nova Scotia and Prince Edward Island, with annual production of approximately 104,000 tons (94,000 tonnes). Mosher operates a quarry, a grinding, drying and bagging plant at Upper Musquodoboit. A new quarry northeast of Halifax is presently being developed and will replace the Upper Musquodoboit quarry as Mosher's principal producer.

Ridge Brokers Ltd. operates a quarry at South Side, Antigonish Harbour. Production of 13,750 tons (12,500 tonnes) of limestone was sold to Scott Paper for its paper mill in 1983.

Scotia Limestone Ltd. operates two quarries: one at Irish Cove producing limestone and one at Kelley Cove producing dolomite. The main market for Scotia Limestone is the supplying of fluxes and refractory material to Sydney Steel Company and production is tied directly to steel-making operations.

Structural Materials and Miscellaneous Materials

Aggregate Resources

At present production of aggregates is from glaciofluvial deposits and rock quarries. Eleven rock quarries and forty-six sand and gravel operations produce aggregates worth approximately $46 million. This is second only to coal in value. The total production was 11,512,163 tons (10,465,602 tonnes) in 1983 which includes 2.8 million tons (2.5 million tonnes) of sand and gravel produced by the Nova Scotia Department of Transportation for their own uses.

Included in this industry are the permanent, usually large-volume construction material producers, intermittent operators working on a seasonal basis, road builders, ready mixed concrete producers and some government departments. Not only do these operations supply all the Provincial construction material requirements but an export business has developed, shipping materials to Prince Edward Island, Iles de la Madeleine and Bermuda. The locations of the largest producers of sand and gravel and crushed stone are shown in Figure 11.

Silica Sand

Nova Scotia Sand and Gravel is presently the only silica sand producer in Nova Scotia with deposits at Elmsvale, north of Halifax, and MacPhee Corner, southwest of Truro. These sands are Early Cretaceous in age and are used for the manufacture of glass containers, fibreglass insulation, and as an industrial sand primarily as an abrasive in sandblasting. The company produced 16,500 tons (15,000 tonnes) during 1983. Several million tons (tonnes) of recoverable reserves of silica sand are known in central mainland Nova Scotia and similar quantities exist in southern Cape Breton. These are high-purity silica deposits up to 99.6 per cent Si0.

Structural Stone

Heritage Memorials Ltd. operates a small quarry at Nictaux West to obtain grey granite from the South Mountain Batholith of Devono-Carboniferous age for its memorial stone works in Windsor. The operation is seasonal and depends on market requirements.

Arsenault Monument Works Ltd. operates two quarries for the production of dimension stone and memorials. Granite is quarried as needed from Devonian granite at Loch Katrine south of Antigonish. Sandstone is produced from a quarry north of Antigonish.

Clay, Shale, Industrial Sand, Marble

L.E. Shaw and its subsidiary company, Nova Scotia Sand and Gravel, operate seven properties in Nova Scotia. The clay and shale are quarried from pits at Lantz, Milford, and Shubenacadie and a quarry in New Glasgow. The materials quarried are used in the company plant located in Lantz for the manufacture of bricks, pipes, and tiles. The company also produces industrial sand at Elmsdale, Brazil Lake, and Sandy Desert and architectural limestone from the Marble Mountain quarry in southeastern Cape Breton.

Peat Moss

Annapolis Valley Peat Moss Co. owns a 500-acre (202 ha) peat bog near Berwick. During the five summer months up to 730 cubic yards (560 m) per day are harvested depending upon the weather. The peat moss is used solely for horticultural purposes and is sold in Nova Scotia, Prince Edward Island and Newfoundland. Surveys by the Nova Scotia Department of Mines and Energy have indicated substantial reserves of thermal peat in the southwestern and northern parts of the Province.

Exploration and Development

Nova Scotia experienced increases in mineral exploration expenditure in the middle and late 1970s (Table 9), from $1.6 million in 1976 to an estimated $7.5 million in 1983 with a high of $14.6 million in 1981. This over-all statement of optimism in Nova Scotia's mineral potential by the private sector was substantiated by the discovery of significant new base-metal, tin, and industrial mineral deposits. A significant component of this record-high expenditure in 1981 was directed toward the search for uranium deposits. These investigations were terminated in 1981 when the provincial government called a moratorium on such activity and established a formal inquiry into all aspects of uranium exploration and mining. Exploration for gold, encouraged by Nova Scotia's history as a gold producer and by rising gold prices, was rewarded with positive results leading to several development initiatives still in progress in 1984.

Record-high levels of exploration activity continued into 1981 but as the economic recession deepened these high levels of expenditure could no longer be maintained. In 1982 exploration expenditure dropped to approximately $5.5 million (Table 9). Although activity was reduced in intensity, interest in Nova Scotia remained high as substantiated by the maintenance of a high proportion of mineral claims in good standing. As proof of this continuing interest, 1983 exploration expenditures increased 35% from 1982 to an estimated value of $7.5 million.

The diversity shown in recent mineral development has a significance which cannot be over-emphasized. The traditional nonmetallic sector of the industry, for example, shows expansion with new developments in coal, gypsum, limestone, aggregate, barite and silica sand. A new tin mine in southwestern Nova Scotia will provide an entirely new dimension to the mining industry in Nova Scotia. Recently announced new coal developments in both Cape Breton and the mainland reinforce the positive nature of this mainstay of the mineral industry.

Nova Scotia looks forward with optimism to the development of offshore oil and natural gas resources. The impact of exploration for these resources has already been felt in the

TABLE 9. Mineral exploration trends in Nova Scotia

		1976	1977	1978	1979	1980	1981	1982	1983
Summary (onshore)									
Value of Reported Assessment Work		$1 600 000	$3 800 000	$5 900 000	$4 700 000	$7 564 000	$ 8 441 270	$4 100 000	$4 200 000
Exploration Expenditure		—	—	—	—	—	$14 608 000	$5 553 000	$7 500 000[1]
Total Licences Issued		1 489	2 894	2 393	1 841	2 559	1 952	1 159	1 350
Claims Recorded Onshore[2] — area in acres (hectares in parentheses)									
Base Metal	claims	34 434	70 936	38 597	40 497	88 703	68 863	39 626	40 390
	acres	1 377 360	2 837 440	1 543 880	1 619 880	3 548 120	2 754 520	1 585 040	1 615 600
	hectares	(557 398)	(1 148 272)	(624 786)	(655 542)	(1 435 874)	(1 114 715)	(641 443)	(653 810)
Uranium	claims	21 526	48 721	31 978	30 920	25 483	6 225	—	—
	acres	861 040	1 948 840	1 279 120	1 236 800	1 019 320	249 000	—	—
	hectares	(348 451)	(788 668)	(517 642)	(500 515)	(412 504)	(100 767)	—	—
Salt Potash	claims	224	887	1 148	2 256	13 505	5 225	1 065	1 257
	acres	8 960	35 480	45 920	90 240	540 200	209 000	42 600	50 280
	hectares	(3 626)	(14 358)	(18 583)	(36 519)	(218 611)	(84 579)	(17 240)	(20 348)
Number of Mineral Assessment Reports		70	90	132	126	140	150	121	143
Total Areas Held Under Licence	acres	2 247 360	4 821 760	2 868 920	2 946 920	5 107 640	3 212 520	1 627 640	1 665 880
	hectares	(909 475)	(1 951 298)	(1 161 011)	(1 192 576)	(2 066 989)	(1 300 061)	(658 683)	(674 158)
Petroleum Licences Issued — area in acres (hectares in parentheses)									
Land Areas	licences	29	20	37	44	52	99	68	93
	acres	2 678 833	2 431 592	3 452 573	3 456 875	4 284 909	6 230 046	5 419 952	8 048 306
	hectares	(1 084 087)	(984 032)	(1 397 209)	(1 398 950)	(1 734 044)	(2 521 214)	(2 193 380)	(3 257 039)
Submarine Areas	licences	179	160	160	147	151	172	168	—
	acres	37 273 269	33 634 964	33 634 964	31 221 055	31 589 070	34 786 199	33 965 867	—
	hectares	(15 083 980)	(13 611 608)	(13 611 608)	(12 634 732)	(12 783 663)	(14 077 497)	(13 745 520)	—

[1] Estimate from Nova Scotia Department of Mines and Energy sources
[2] Claims are 40 acres or 16.2 ha each

mining sector, with heightened interest in local sources of barite for use as a drill-mud additive. The newly opened mine of Novex Mining and Exploration Co. Ltd. and the anticipated reopening of the Magcobar Walton operation reflects the response to this impact, as does a general high level of additional barite development projects.

Of broader consequence, perhaps, is the potential impact of general development arising from successful oil and gas exploration which would generate significant demand on many industrial mineral resources, particularly those closely related to the construction industry. Nova Scotia is fortunate in having a strong industrial mineral base, potentially capable of responding to meet this demand.

With the diversity of geological environments and the wide variety of elements and commodities, the Province has much potential. The background of a mining heritage and the importance of existing mining activities to the Provincial economy provides a positive base for optimism in the future expansion of mining in Nova Scotia.

Acknowledgments

I have benefitted from discussions with Jack Garnett, Peter Giles, John Fowler and Peter Rogers in the preparation of this article. Many parts of the manuscript are from previously written internal reports and publications now out of print. Sherry Edmonds and Anne Van Inderstine assisted in the research. The manuscript was prepared by Susan Saunders and Rita Jones. The figures and photographs were done by Wayne Burt, Cynthia Phillips, Dan Bernasconi, Reg Morrison, and Carol McKinnon. I wish to thank Rio Algom Ltd., the Nova Scotia Museum, and the Public Archives of Nova Scotia for the use of photographs. John Hartlen answered many of our questions about gold mining in Nova Scotia. I thank the Nova Scotia Department of Mines and Energy for permission to publish this article.

REFERENCES AND SELECTED BIBLIOGRAPHY

ANDREAE, CHRISTOPHER. 1983: Nineteenth century Nova Scotia iron works; *CIM Bulletin, V. 76, No. 853, pp. 84-89.*

BELL, W.A. 1958: Possibilities for occurrence of petroleum reservoirs in Nova Scotia; Nova Scotia Department of Mines, 177 p.

BOYLE, R.W. 1972: The geology, geochemistry, and origin of the barite, manganese, and lead-zinc-copper-silver deposits of the Walton-Cheverie area, Nova Scotia; Geological Survey of Canada, Bulletin 166, 181 p.

GAUDETTE, H.E., OLSZEWSKI, W.J., and DONOHOE, H.V. 1983: Age and origin of the basement rocks, Cobequid Highlands, Nova Scotia; Geological Society of America, Abstracts with Programs, V. 15, No. 3, p. 136.

GREGORY, DIANE J., and RICHARDSON, JEAN M. 1976: Geology, minerals, and mining in Nova Scotia; Nova Scotia Department of Mines and Energy, Information Series No. 1.

GREGORY, DIANE J., RICHARDSON, JEAN M., and BISSON, LISE M. 1978: A history of coal in Nova Scotia; Nova Scotia Department of Mines and Energy, Information Series No. 2.

HARTLEN, JOHN A. 1982: Early Nova Scotia gold mining; *CIM Bulletin, V. 75, No. 846, pp. 125-126.*

HARTLEN, JOHN A. 1983: Nova Scotia's golden past; Prospectors and Developers Association, *Recorder, March 1983.*

HEATHERINGTON, A. 1868: A practical guide for tourists, miners, and investors and all persons interested in the development of Gold Fields of Nova Scotia; Montreal, John Lovell.

MALCOLM, V. 1912: Gold fields of Nova Scotia; Geological Survey of Canada, Memoir 156, 253 p.

MILLER, CRAIG K. 1979: The geologic setting and environment of ore deposition at the Mindamar Mine, Stirling, Richmond County, Nova Scotia; Dalhousie University, unpublished M.Sc. thesis, 223 p.

MOSSMAN, D.J. 1982: Nova Scotia Gold; *The Mineralogical Record, Nov.-Dec. 1982, pp. 335-344.*

MOYLE, J.E. 1984: Development and construction begins at East Kemptville, North America's only primary tin mine; *Mining Engineering, April 1984, pp. 335-336.*

NOVA SCOTIA DEPARTMENT OF MINES: A brief history of mining and geology in Nova Scotia; Nova Scotia Department of Mines and Energy, Halifax.

NOVA SCOTIA DEPARTMENT OF MINES AND ENERGY, 1983: Oil and gas exploration in Nova Scotia, 1983-84; Nova Scotia Department of Mines and Energy, Halifax.

PARKS, W.A. 1914: Building and ornamental stones of Canada; Canada Department of Mines, Mines Branch, No. 203.

SPENCE, HUGH S. 1922: Barium and strontium in Canada; Canada Department of Mines, Mines Branch, No. 570, 100 p.

WEEKS, L.J. 1948: Londonderry and Bass River map areas, Colchester and Hants Counties, Nova Scotia; Geological Survey of Canada, Memoir 245, 112 p.

WRIGHT, J.D. 1975: Iron deposits of Nova Scotia; Nova Scotia Department of Mines, Economic Geology Series, 75-1, 154 p.